MODEL 41-3A

SERVICE ANALYZER

INSTALLATION AND OPERATION

A0041-13-614

ISSUE 1, DECEMBER 1985

northeast electronics
DIVISION OF tau-tron inc.
A UNIT OF GENERAL SIGNAL

PAGE 89 TABLE Q REFERENCE: DIAL MODE DESCRIPTION
DELETE THE DESCRIPTION AS IS, AND ADD THE FOLLOWING:

ASCII DIGIT 1 = DP, 2 = FIXED DTMF, 4 = MF, 8 = DTMF

PAGE 90 TABLE Q SIT FLAGS

ADD CATEGORY 50. NO PROMPT

PAGE 91 TABLE R DIAL MODE DESCRIPTION
DELETE THE DESCRIPTION AS IS, AND ADD THE FOLLOWING:

ASCII DIGIT 1 = DP, 2 = FIXED DTMF, 4 = MF, 8 = DTMF

PAGE 92 TABLE R SIT TOTALS

ADD THE CATEGORY 50. NO PROMPT

MODEL 41-3A

INSTRUCTION MANUAL

A0041-13-614

ADDENDUM

ISSUED APRIL 1986

CHANGES:

PAGE 46 PARAGRAPH 3.34 -- ADD THE FOLLOWING:

NOTE: WHEN THE UNIT IS EQUIPPED WITH THE REMOTE OPTION, CAMA-ANI CALLS CAN BE MADE WITHOUT OBSERVING THE LINE REVERSAL CONDITIONS. FOR THIS TYPE OF CAMA CALLING REFER TO SECTION 4.31.

PAGE 77 PARAGRAPH 4.31 -- DELETE IN ITS ENTIRETY, AND ADD THE FOLLOWING:

4.31 A TEST CALL NUMBER CAN CONSIST OF UP TO 32 DIGITS AND CODES. IN ADDITION TO DIAL DIGITS 0 THROUGH 9, THE DTMF DIAL CODES * (ASTERISK) AND ♯ (OCTOTHORPE) CAN ALSO BE USED. (DTMF DIAL CODES A, B, C, AND D CAN NOT BE PROGRAMMED.) THE MF DIALING CODES KP AND ST ARE NOT PROGRAMMED WITH ADDRESS DIGITS; THE 41-3A AUTOMATICALLY TRANSMITS THESE CODES AT THE PROPER TIME. PROGRAM W, E, AND D CODES WITHIN THE ADDRESS AS NEEDED; THE ENTRY 9W2283700, FOR EXAMPLE, PROGRAMS A WAIT-FOR-START-DIAL (W) CONDITION AFTER THE DIGIT 9 IS DIALED. FOR CAMA-ANI DIGITS, CODE D OR E SEPARATES THE CALLED PARTY NUMBER FROM THE CALLING PARTY NUMBER FOR EITHER A DELAY INTERVAL OR A WAIT-FOR-WINK INTERVAL. CREDIT CARD CALLS CONSIST OF R, M, OR L CODES AFTER THE CALLED NUMBER IS PROGRAMMED TO ALLOW THE UNIT TO DETECT THE PROMPT TONE BEFORE DIALING THE CALLING CREDIT CARD NUMBER. THE R, M, AND L CODES SIGNIFY A REDUCED (10 SECONDS), MEDIUM (18 SECONDS), AND LONG (28 SECONDS) INTERVAL ALLOWED TO DETECT THE PROMPT BEFORE THE UNIT DECLARES A "NO PROMPT" FAULT. AFTER THE R, M, OR L IS PROGRAMMED, THE CALLING CARD NUMBER IS PROGRAMMED.

PAGE 78 PARAGRAPH 4.45 -- DELETE THE NOTE -- AND ADD THE FOLLOWING:

NOTE: ALTHOUGH ALL REPORTS ARE TRANSMITTED, THE MODEL 41-3A HAS SUFFICIENT MEMORY TO GUARANTEE AT LEAST 188 REPORTS (CALL OR SUMMARY) CAN BE RETAINED AT ANY ONE TIME FOR LATER RETRIEVAL. REPORT AND STORE REQUESTS MUST BE MADE CAREFULLY, AS A SINGLE ADDRESS INSTRUCTION COULD RESULT IN THOUSANDS OF REPORTS.

PAGE 81 PARAGRAPH 4.59 -- ADD THE FOLLOWING CATEGORY:

♯ PROMPT FAULTS (ONLY WHEN RELEVANT)

MODEL 41-3A
SERVICE ANALYZER
INSTALLATION AND OPERATION
A0041-13-614
ISSUE 1, DECEMBER 1985

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SERVICE ANALYZER
INSTALLATION AND OPERATION

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1. INTRODUCTION

A. General

1.01 This manual provides instructions for the installation and operation of the basic Model 41-3A Service Analyzer and its associated options. Available factory–equipped 41-3A units, field kits, and other associated products are listed in Table A.

1.02 As in the past, the current 0041-13-909 basic 41-3A unit is operated via its front panel controls. When equipped with an Expanded Remote Control (ERC) option, the Model 41-3A can also be controlled and operated from a local/remote keyboard terminal or by a computer. The ERC option is available as a factory-installed feature; or, it can be provided as a field kit for retrofitting a basic Model 41-3A.

1.03 Additional enhancements, the C-Message Noise, 1-kHz Level Measurement, and Special Information Tone options are available as augmentations to the ERC option. These features can also be installed at the factory or retrofitted to a basic 41-3A unit via a CMSG/1KHZ or SIT/CMSG/1KHZ field kit.

TABLE A

MODEL 41-3A STRUCTURE AND ASSOCIATED PRODUCTS

PART NUMBER	DESCRIPTION
0041-13-909	Model 41-3A basic unit with no options. (This unit replaces the older 0041-13-900 basic unit and its associated 0041-13-901 MF option.)
0041-13-910	Model 41-3A with a factory-installed Expanded Remote Control (ERC) Option. (This unit replaces the older 0041-13-905 unit and its associated 0041-13-906 MF Option.)
0041-13-911	ERC field kit used to retrofit a basic 0041-13-909/900 unit. (This kit replaces the old 0041-13-904 remote control field kit.)
0041-13-912	C-Message Noise & 1-kHz Level Measurement (CMSG/1KHZ) Option (operates only when installed with the ERC Option).
0041-13-913	Special Information Tone, Prompt Tone, C-Message Noise, and 1-kHz Level Measurement (SIT/CMSG/1KHZ) Option (operates only when installed with the ERC Option).
0041-13-914	Model 41-3A with factory-installed ERC, CMSG, 1KHZ, and SIT options.
5900-00-910/911	Hazeltine Esprit video terminal (115/230 Volts) with cable. *Note:* A hard copy teleprinter suitable for use with the Model 41-3A with ERC is also available. (Contact your NED representative for details.)
5900-00-920/912	MFE Model 2500 Cassette Tape Drive (115/230 Volts) with cable and one cassette tape.
5900-00-922	Tape kit consisting of ten cassette tapes.
3541-00-900	4-Wire Adapter. (This unit expands the application of the Model 41-3A from a two-point system to four and six-wire point systems.)

Notes:

1. The 0041-13-909 basic unit is identified by the following decal (located above rear panel filter housing).

   Model 41-3A with MF
   0041-13-909

2. The Model 41-3A with ERC is identified by a second decal (above the first decal).

   Model 41-3A Expanded Remote
   0041-13-910/11

TABLE A (Cont'd)

Notes:

3. If the Model 41-3A also has the C-Msg/1kHz Level option, it is identified by a third decal (above the second decal).

Model 41-3A C-Msg/1kHz Level 0041-13-912

4. If the Model 41-3A also has the SIT option it is identified by a fourth decal (left adjacent to the third decal).

Model 41-3A SIT Option 0041-13-913

B. Initial Inspection

1.04 Products are carefully inspected before shipment. Note any damage to shipping containers. Carefully unpack the product and inspect for damage. If damage from transit is found, immediately inform the carrier and contact our Traffic Department at 603-228-3700. Check the equipment received against the purchase order agreement, shipping list, and any wiring documentation provided by NED. Report missing items to our Customer Service Department.

C. Service Information

1.05 Terms and conditions of sale are contained in the Sales Order Acknowledgement. Briefly, the warranty for this product can be summarized as follows.

- OEM items are warranted for a period of 90 days.
- Hardware and software items are warranted for a period of one year.

1.06 If a product fails to perform as expected, call our Service Center in Concord, New Hampshire at 603-228-3700 for assistance. This step helps prevent the unnecessary return of a product.

1.07 Prior to returning a product for factory service, call our Service Center to obtain a Return Material Authorization (RMA) Number. Return products directly to our Service Center in Concord, New Hampshire. If a product is still under warranty, include a ship-to address and a description of the problem. After the warranty period, include all of the following information:

- Purchase Order Number
- Bill-to address
- Ship-to address
- Description of problem.

D. Product Specifications

1.08 Specifications for the Model 41-3A and its optional features are listed in Tables B and C.

TABLE B

BASIC MODEL 41-3A SPECIFICATIONS

ORIGINATING LINES	
Line Capacity	16 lines
Line Types	Wet loop T/R or T/R/S leads
Line Impedance	600 or 900 ohms

TABLE B (Cont'd)

ORIGINATING LINES	
Sleeve Lead	
Busy Condition	Ground or a potential more positive than −7V
Idle Condition	Open circuit or a potential more negative than −11V (4 volts of hysteresis provided to prevent indecision)
Busy-to-Reselect time	100 +/− ms
Line Seizure (off-hook)	Active hold with 15 mA
DIALING	
Types	Loop dial pulse (DP), Touch-Tone® (TT), or multifrequency (MF)
Digit Capacity	Up to 32 programmed digits and WSD (wait for start dial) commands
Dial Pulsing	
Dial Speed Range	Selectable 1 to 99 pps in 1-pps increments
Dialing Speed Accuracy	+/− 0.1% for 1 to 30 pps range
Percent Break Range	1 to 99% in 1% increments
Percent Break Accuracy	+/− 0.1% for 35% to 85% range over a 1 to 30 pps range
Interdigit Time Range	1 to 999 ms in 1-ms increments
Interdigit Time Accuracy	Better than +/− 1 ms
Transient Suppression	325 +/− 25 Vdc
Touch-Tone® Dialing	
Frequency	Standard dual-frequency tones
Frequency Accuracy	+/− 1%
Single Frequency Output Level	−6.0 +/− 0.5 dBm into 900 ohms
Single Frequency Harmonic Distortion	Less than 3% over a 30-kHz bandwith

TABLE B (Cont'd)

DIALING (Cont'd)	
Dialing Speed	1 to 99 digits per second in 1 digit per second increments
Speed Accuracy	+/− 0.1% for 1 to 30 digits per second
Tone-on Duration	1 to 99% in 1% increments
Duration Accuracy	+/− 1% for 35% to 85% tone-on range over 1 to 30 digits per second range
Multifrequency Dialing	
Type	Standard R1 MF pulsing (KP and ST tones automatically transmitted)
Frequency Accuracy	+/− 1%
Single Frequency Output Level	−6.0 +/− 0.5 dBm into 600 ohms
Single Frequency Harmonic Distortion	Less than 3% over a 30-kHz bandwidth
Dialing Speed	1 to 99 digits per second in 1 digit per second increments
Speed Accuracy	+/− 0.1% for 1 to 30 digits per second
Tone-on Duration	1 to 99% in 1% increments
Duration Accuracy	+/− 1% for 35% to 85% tone-on range over 1 to 30 digits per second range
Twist	1 dB or less
DETECTION CRITERIA	
Answer Supervision	T/R lead reversal lasting longer than approximately 312 ms
Open C-lead	Loss of C-lead ground lasting longer than 512 ms *Note:* When an open C-lead is detected, the Model 41-3A holds the switched connection with approximately 180 mA of sleeve current.
1-kHz Level Detector	
Frequency Range	990 to 1020 Hz

TABLE B (Cont'd)

DETECTION CRITERIA (Cont'd)	
No-tone Threshold	−31 +/− 1 dBm from 600/900 ohms
Response Time	2 =/− 0.5 seconds
Level Limit Accuracy	+/− 0.5 dB from +10 to −10 dBm and +/− 1 dB from −11 to −31 dBm
Busy/Reorder Detector	
Frequency Range	200 to 650 Hz
Sensitivity	−30 dBm from 600/900 ohms
Busy Pulse Modulation Rate	45 to 75 ipm
Reorder Pulse Modulation Rate	100 to 140 ipm
On/Off Level Ratio	Greater than 6 dB
Number of Interruptions	3 for busy tone, 6 for reorder tone
Tone-on Duty Cycle	20 to 80%
Wink/Delay Dialing Detection	Reversed tip/ring polarity present on the line under test for at least 128 milliseconds followed by a return to normal polarity that lasts for at least 200 milliseconds. *Note:* The line under test can be in either the normal or reversed state prior to seizure.
INCOMING CIRCUIT TEST LINE	
Pre-Trip Impedance	Approximately 47 kohms at 20 Hz
Trip Impedance	Approximately 850 ohms at 20 Hz
Trip Criteria	20–60 Hz ringing voltage across T/R leads at 65 volts rms or greater
Quantity of Rings to Trip	1 lasting for more than 600 ms
Sleeve Active (Busy)	Open circuit, ground, or any potential more positive than −7V
Sleeve Inactive (Idle)	Any potential more negative than −11V (4V of hysteresis provided to prevent indecision)
Signal Output	1004 +/− 10 Hz at 0 dBm into 900 ohms

TABLE B (Cont'd)

INTERNAL TRACE TONE	
Frequency	1165 =/− 500 Hz, gated on/off at 4 Hz rate (240 ipm)
Tone-on Level	Approximately 0 dBm into 900 ohms
Loop Holding Resistance	900 +/− 90 ohms dc
DATA STORAGE	
Stored Event Categories	Total test calls Tests on Channel A Tests on Channel B No dial tone (and/or no wink) Open C-lead Reversal during dialing Reorder and answer Busy and answer Reorder (and no answer) Busy (and no answer) Low level No 1-kHz tone High level No answer Incoming circuit fault Test OKs
Storage Capacity	9999 events per category *Note:* Instant recall is provided via individual readout switches. An over-range indication is shown if a register count exceeds 9999 (total tests category) without affecting the contents of other registers.
INPUT POWER	105 to 120 or 215 to 240 Vrms, 50 to 60 Hz, approximately 60 watts
OPERATING ENVIRONMENT	
Temperature	+32°F to +122°F (0°C to +50°C)
Humidity	0% to 90% relative
MECHANICAL	
Size	9 in. h x 17 in. w x 18 in. d (23 cm x 43 cm x 46 cm)
Weight	Approximately 40 pounds (18.2 kg)

TABLE C

ERC SPECIFICATIONS

COMMUNICATION	
Format	Full-duplex, serial asynchronous ASCII
Baud Rate	Selectable 50 to 19200 (factory set at 1200)
Character rate	< /= 120 characters per second (maximum baud rate of 1200) for received data
Character bits	1 start bit 7 data bits 1 stop bit for baud rates >/= 134.5 2 stop bits for baud rates < /= 110 1 parity bit
Parity code	The Model 41-3A ignores the parity bit when receiving information, and sets the parity bit to zero when transmitting.
INTERFACE PORT	
	RS-232-C and 20–mA loop interfaces on a 25-pin, Type D, female connector (REMOTE TERMINAL port)
Twenty milliamp loop	Must be set for active or passive
RS-232-C	Female DCE type connector converted to male via special null modem cable interconnection
PROGRAMMING	
Call program	Programmable control switch and address instructions
Instructions	256 maximum
Addresses	256 maximum at 32 characters per address instruction
Test calls	1 to 9999 per address
Test call results	User selected reports and data transfer
MEMORY PROTECTION	
	Internal battery backup for preservation of data stored in RAM memory

TABLE C (Cont'd)

MEMORY PROTECTION (Cont'd)	
Battery charge	A minimum 48 hours of continuous unit operation is required to fully charge battery
Minimum protection	10 hours
LEVEL MEASURMENTS	
	Requires C-Message Noise & 1-kHz Level Measurement Option *Note:* The Model 41-3A applies an internal 735-ohm termination to a call origination line while it is in an off-hook condition
C-Message measurement	Milliwatt signal must be present for a minimum interval of 4000 milliseconds, then absent for a minimum interval of 5000 milliseconds
Level range	+15 to +55 dBrnC
Accuracy	+/− 1 dB
1-kHz measurement	Milliwatt signal must be present for a minimum interval of 4000 milliseconds
Level range	−30 to +10 dBm
Accuracy	+/− 1 dB
SIT SIGNAL DETECTION	
	Requires Special Information Tone (SIT) Option
Signal decoding	The SIT detector recognizes all 32 frequency/pulse-width signal codes specified by AT&T Compatibility Bulletin CB154
Tones detected	913.8, 985.2, 1370.6, 1428.5, and 1776.7 Hz with a minimum accuracy of +/− 1.5%
Minimum tone level	−30 dBm at 735 ohms
Minimum acceptable pulse-widths	274 ms +/− 5% 380 ms +/− 5%
Minimum acceptable gap range	0 - 4 ms
PROMPT SIGNAL DETECTION	
	Requires SIT Option

TABLE C (Cont'd)

PROMPT SIGNAL DETECTION (Cont'd)	
Signal Decoding	Detects the presence of the DTMF "#" character during credit card calls
Tone Detected	914 & 1477 Hz +/− 1.5% (No other DTMF) Tone level each 0 TO −20 dBm (750 ohm) twist ◄ = +4 to −8 db (HF to LF) duration, simultaneous present = ► 40 milliseconds
Start Command	Initiates dialing of calling party digits starting 2 +/− 0.5 seconds after reception of prompt.
Failure Analysis	Declare "NO PROMPT" if no prompt tone occurs after last address digit within: 10 sec +/− 0.5 IF "R" Programmed 18 sec +/− 0.5 IF "M" Programmed 28 sec +/− 0.5 IF "L" Programmed

2. INSTALLATION

PRECAUTION: The following installation procedures are intended for use by technically qualified personnel. Where solid-state devices are involved for example, normal handling precautions should be exercised to eliminate the possibility of PROM damage. The installer should leave such a device in its original container until ready for installation, obtain a well grounded work surface, and wear a wrist grounding strap while handling the device.

A. Field Kits

2.01 The following field kit instructions pertain to Model 41-3A units which are not factory-equipped with the Expanded Remote Control (ERC) feature and/or its associated Special Information Tone (SIT), C-Message Noise (CMSG), and 1-kHz Level Measurement (1KHZ) features.

Note: The SIT, CMSG, and 1KHZ features all operate independently of each other, but each is functional only when installed in a Model 41-3A equipped with the ERC feature.

2.02 ERC KIT

2.03 The Expanded Remote Control field kit (0041-13-911) contains the following items:

- Two circuit boards
- One cable assembly with mounting hardware
- A decal placement kit
- A special modem interconnection cable.

Note: Instructions for use of the special modem interconnection are given later (under Part F: External Cable Connections). This cable can be removed from the ERC kit at this time but retain it for later use.

2.04 The ERC kit is installed as follows.

(1) Set the Model 41-3A's POWER switch down (off) and remove its input power cord.

(2) Remove the 41-3A's top cover by removing the rear corner screw on each side of the unit. This step allows access to the card cage.

(3) The ERC retrofit kit contains a TTY interface board and cable assembly which must be installed in the Model 41-3A as shown in Fig. 1. If the unit being retrofitted is an older 0041-13-900 type Model 41-3A, it may already contain an interface board and cable assembly—both of which must be removed prior to installing the new ERC components as explained in steps 4 thru 17.

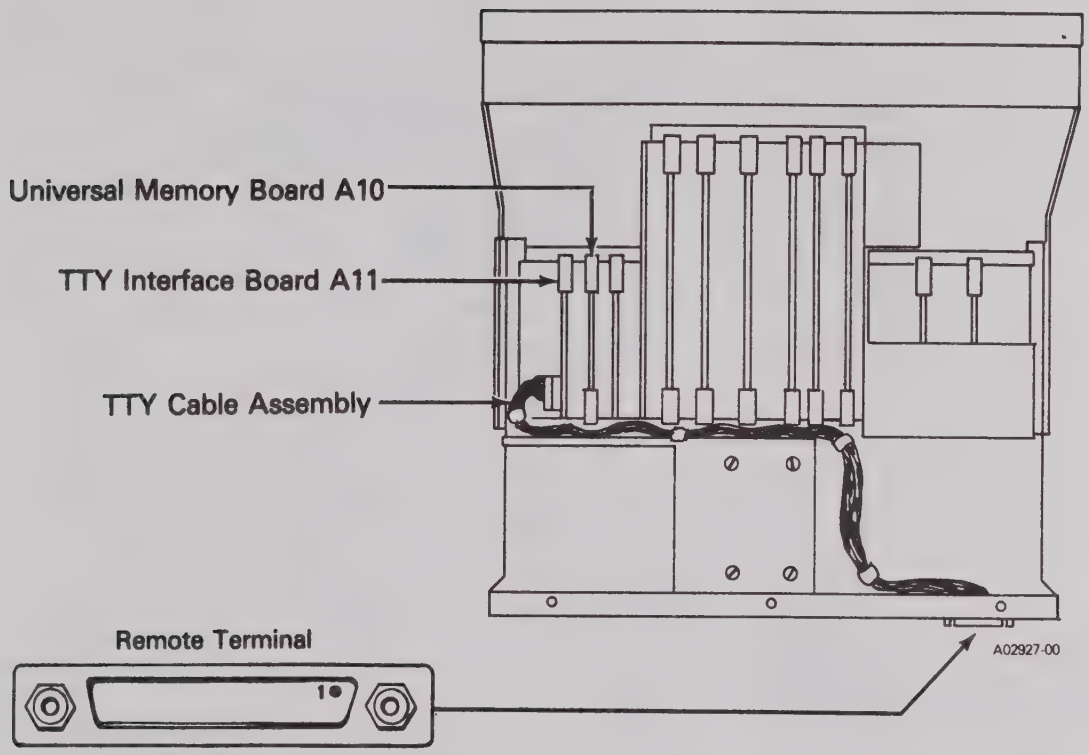


Fig. 1 — ERC Components

(4) Locate switch assembly S1 in the upper left portion of the new TTY interface board. Refer to Fig. 2 and set S1 in accordance with the terminal device that will be used with the Model 41-3A.

Note: All products used in a Model 41-3A system configuration must be set at the same baud rate.

(5) If a teletype printer will be used, the TTY interface board must be strapped for either passive or active operation of the 20-mA printer loop. This operation is described in steps 6, 7, and 8. If an RS-232-C compatible printer will be used, skip directly to step 9.

(6) Locate three jumper straps at the top center of the board (see Fig. 2 for the designated A, B, C, C', X, Y, and Z strapping posts).

(7) If the teletype uses a built-in current source to drive its printer, strap the TTY interface board for passive operation as follows:

- A to Y
- B to Z
- C to C'.

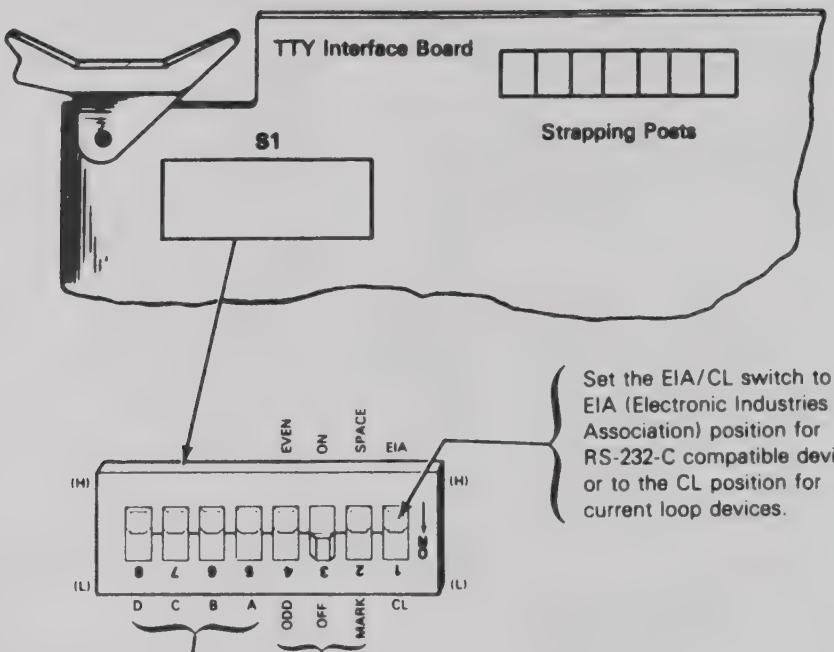
(8) If the teletype has a built-in current source, strap the TTY interface board for active operation as follows:

- A to X
- B to Y
- C to Z.

(9) Install the TTY interface board in card slot 11—face the component side of this board away from card slot 10.

(10) Locate the REMOTE TERMINAL jack on the rear of the Model 41-3A. If this jack location is covered by a plate, remove the cover plate. (Two nuts secure the plate.)

(11) The ERC kit's cable assembly has one small plug wired to a larger 25-pin connector. Place this cable assembly inside the Model 41-3A and pass the 25-pin connector through the REMOTE TERMINAL slot as shown in Fig. 1. Position the flange of the connector against the outside surface of the rear panel. Use the standoffs, nuts, and washers provided in the kit to secure the connector in place. Insert the standoffs from outside the rear panel, and attach washers and nuts from inside.



BAUD RATE (See Note)	D	C	B	A
50	L	L	L	L
75	L	L	L	H
110	L	L	H	L
134.5	L	L	H	H
150	L	H	L	L
300	L	H	L	H
600	L	H	H	L
1200	L	H	H	H
1800	H	L	L	L
2000	H	L	L	H
2400	H	L	H	L
3600	H	L	H	H
4800	H	H	L	L
7200	H	H	L	H
9600	H	H	H	L
19,200	H	H	H	H

PARITY CODE	EVEN/ ODD	ON/ OFF	MARK/ SPACE
EVEN	EVEN	ON	X
ODD	ODD	ON	X
PARITY BIT ALWAYS MARK (1)	(either)	OFF	MARK
PARITY BIT ALWAYS SPACE (0)	(either)	OFF	SPACE

Note: The Model 41-3A ignores the parity bit when receiving, and sets the parity bit to 0 when transmitting.

Note: The Model 41-3A transmits data over the full range of baud rates given; however, it receives data at a maximum baud rate of 1200 baud.

A02806-00

Fig. 2 — TTY Switch S1 and Strapping Posts

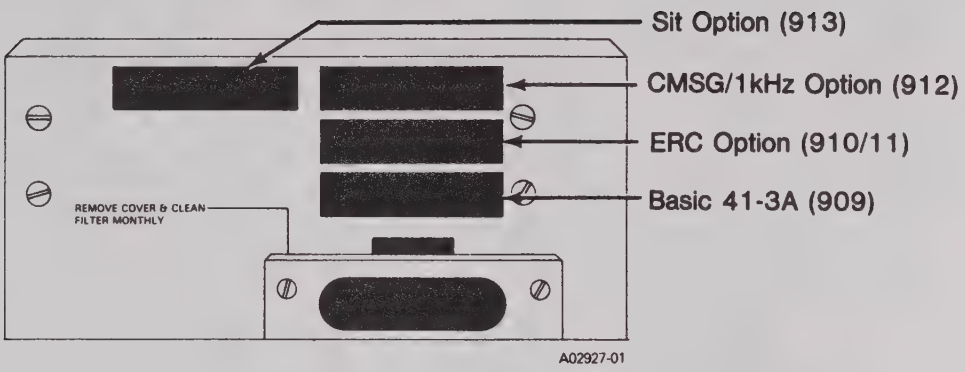


Fig. 3 — Model 41-3A Decals

(12) The small plug of the cable attaches to the jack at the top of the TTY interface board. Ensure that pin 1 of the plug is aligned with the red dot on the jack.

(13) The ERC kit contains a new memory board for card slot 10. If a memory board is already present in slot 10, remove this older memory board and return it to Northeast Electronics.

(14) Locate the kit's ERC decal and position it on the rear panel as in Fig. 3. Note that the position of all option decals as well as the basic 41-3A unit decal are shown in Fig. 3. The decals actually posted on a unit will of course depend on what features are installed.

(15) If the Special Information Tone kit is to be included as part of the ERC feature, go directly to paragraph 2.05 (SIT Kit). Otherwise, continue with step 16.

(16) If only the C-Message Noise & 1-kHz Level Measuring feature, without the SIT feature, is to be included as part of the ERC feature, go directly to paragraph 2.08 (CMSG/1KHZ Kit). Otherwise, continue with step 17.

(17) Replace the 41-3A's top cover and reconnect the unit's power cord.

2.05 SIT Kit

2.06 The Special Information Tone, Prompt Tone, C-Message Noise, and 1-kHz Level Measurement field kit (0041-13-913) contains the following components:

- Two firmware PROM assemblies
- A firmware insertion tool with instructions
- Two circuit boards
- One cable assembly with mounting hardware
- Components of the CMSG/1KHZ field kit (0041-13-912).
- Prompt Detector installation instructions

2.07 The SIT kit is installed as follows.

(1) The SIT feature is functional only in a Model 41-3A equipped with the ERC feature. Check that the ERC feature has been either factory-installed or retrofitted in accordance with paragraph 2.02 (ERC Kit) before installing the SIT kit.

(2) Remove the unit's TTY interface board from card slot 11 and find switch S2, located as shown in Fig. 4. Ensure that this switch is set to the EIA position and a baud rate of 1200 as shown in Fig. 4. Return the board to slot 11. Refer to Fig. 2, and assure that switch S1 is set at 1200 baud rate.

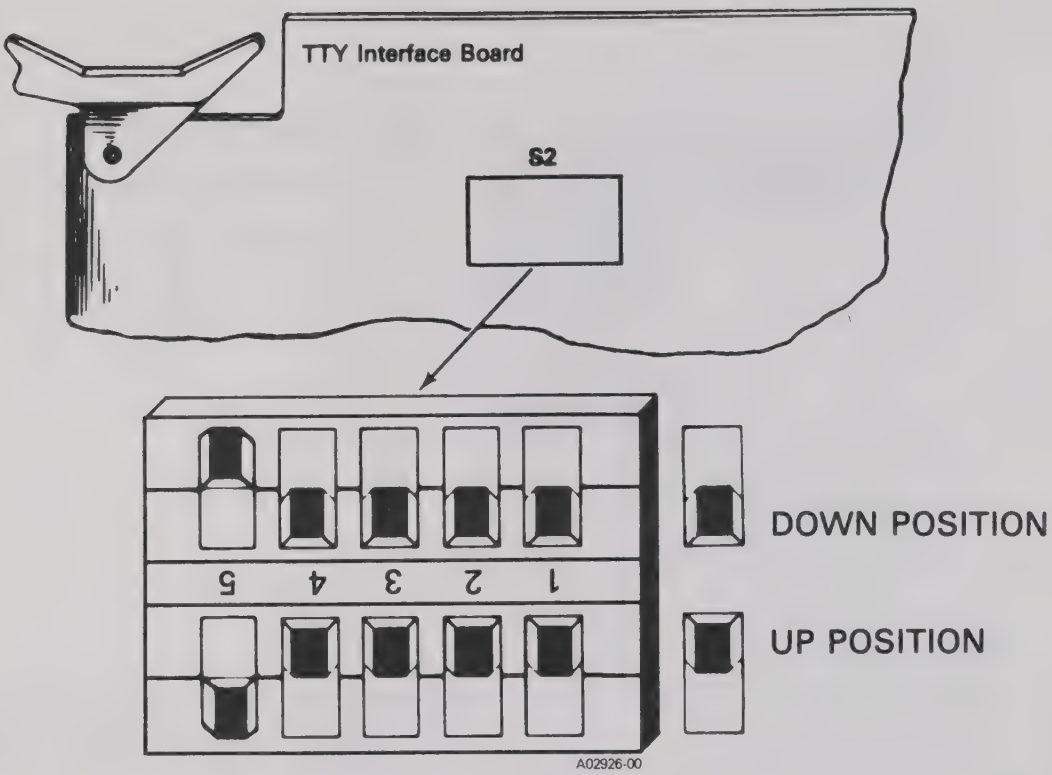


Fig. 4. — SIT Switch S2

(3) Remove the current memory board in card slot 10 of the 41-3A. The SIT kit contains two SIT firmware PROMs which mount on the memory board as shown in Fig. 5. Replace the modified memory board in card slot 10.

(4) The SIT kit contains a cable assembly and a circuit board. Insert the circuit board into slot 3. The SIT cable assembly has two small plugs wired to a larger 25-pin connector. If the unit has an older ERC cable, remove it.

(5) Install the new SIT cable as shown in Fig. 6. Note that the short end of the SIT cable connects to the SIT board. Ensure that pin 1 of each plug is aligned with the red dot on the jack.

(6) Go directly to paragraph 2.08 (CMSG/1KHZ Kit).

2.08 CMSG/1KHZ Kit

2.09 The C-Message Noise & 1-kHz Level Measurement field kit (0041-13-912) contains the following components:

- A circuit board
- A paired cable
- A transformer shield with mounting hardware
- A decal placement kit.

2.10 The CMSG/1KHZ kit is installed as follows.

(1) The CMSG/1KHZ feature is functional only in a Model 41-3A equipped with the ERC feature. Ensure that the ERC feature has been either factory-installed or retrofitted in accordance with paragraph 2.02 (ERC Kit) prior to installing the CMSG/1KHZ kit.

(2) Obtain the C-message/1-kHz board from the retrofit kit. Temporarily disconnect the TTY cable connection to the TTY interface board to allow insertion of the C-message/1-kHz board in card slot 12—face the component side of this board away from card slot 11. Ensure that pin 1 of the jack is aligned with the red dot on the plug when the TTY cable is reconnected.

(3) Remove the card cage shield shown in Fig. 7. (Three nuts secure the shield.)

(4) Compare the Line Switching Interface Board, located in card slot 1, with Fig. 8. If the interface board is already equipped with the transformer shield shown in view B of Fig. 8, then the U-shaped shield provided in the SIT kit (with standoffs and other hardware) is not needed. If the board does not have a transformer shield, then

mount the kit's shield on the board as shown in view B. Position two mounting holes as shown in view A of Fig. 8 so that the shield and its standoffs do not make contact with other components.

(5) Replace the switching interface board in the card cage, and replace the card cage shield previously removed in step 3.

(6) Replace the top cover of the 41-3A and remove the bottom cover.

(7) Compare the exposed non-component side of the Mother Board to Fig. 9. The CMSG/1KHZ feature requires continuity between pin 22 of socket XA12 and pin 7 of XA2, and also continuity between pin Z of XA12 and pin Z of XA1. If these pins are not already interconnected, use the two-wire cable supplied by the CMSG/1KHZ kit to make the necessary connections. Note one of the cable wires is used to interconnect pin Z of XA12 to the ground bus which has a pc connection to pin Z of XA1.

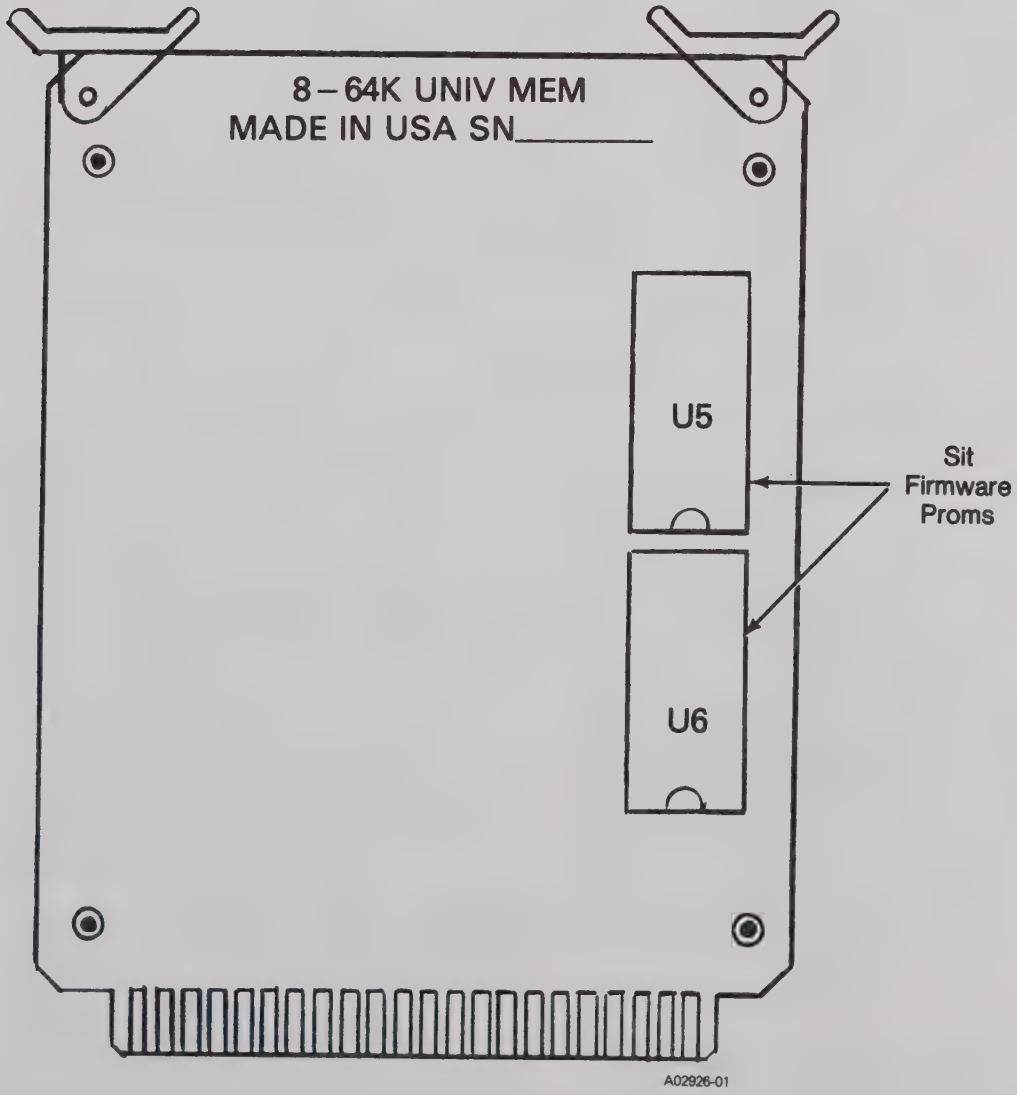


Fig. 5 — SIT Firmware Installation

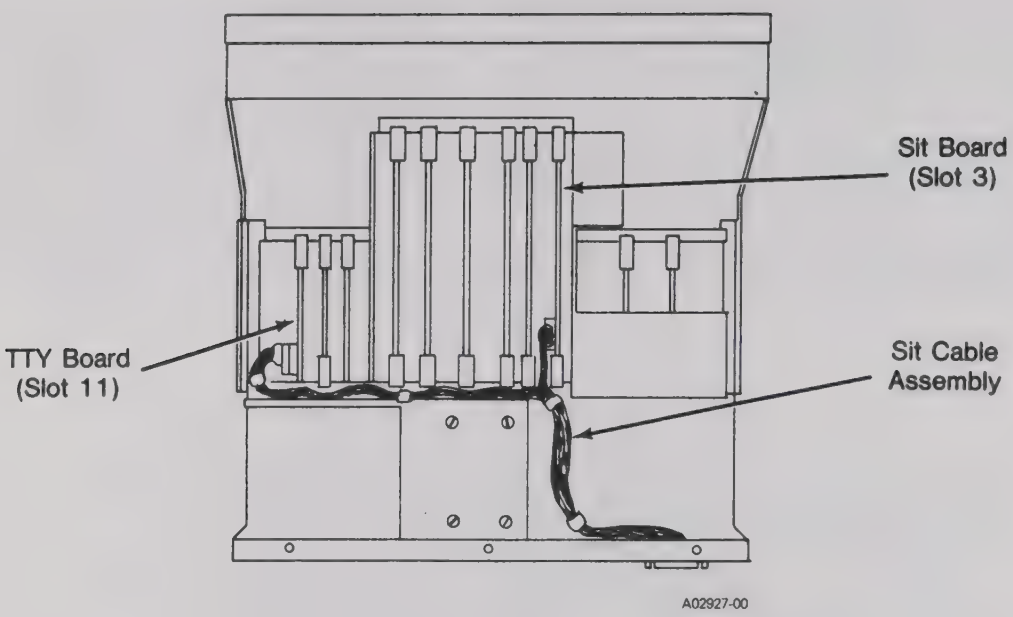


Fig. 6 — SIT Board and TTY Cable Connection

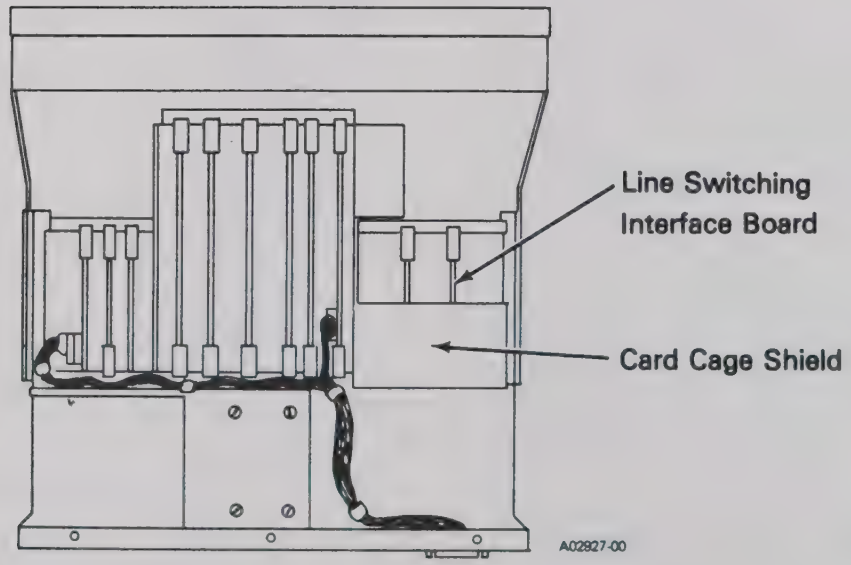


Fig. 7 — Card Cage Shield

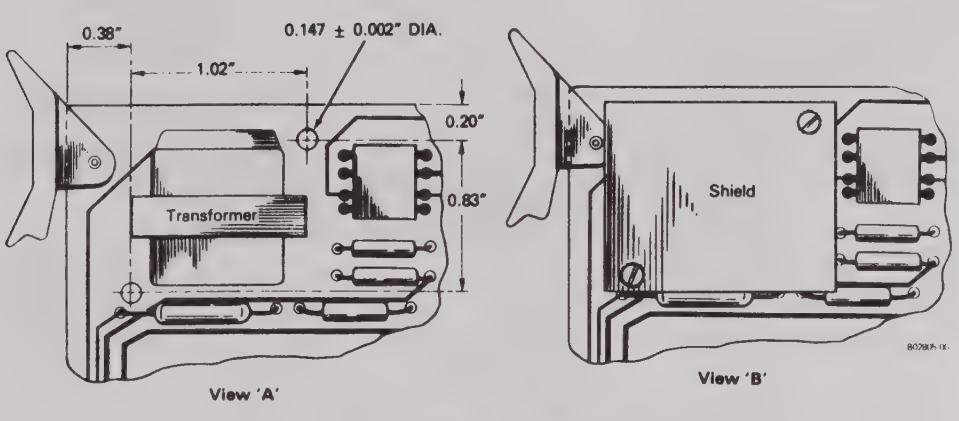


Fig. 8 — Transformer Shield

(8) Replace the top and bottom covers of the 41-3A.

(9) Refer to Fig. 3 to properly position the CMSG/1KHZ decal. If the CMSG/1KHZ kit was installed as part of the SIT kit, then the SIT decal is also posted, as shown, at the left of the CMSG/1KHZ decal.

(10) Reconnect the unit's power cord.

B. Air Flow Requirement

2.11 The Model 41-3A is a portable instrument which can be placed on a convenient work table or shelf. The Model 41-3A is not factory equipped for permanent rack mounting. If rack mounting is desired, first mount a supportive shelf in the rack. Then, ensure that the Model 41-3A unit is placed on the rack shelf with the proper air flow clearances shown in Fig. 10. A rear clearance of five inches is required for cable connections and the cool air inlet. Also, one inch clearances at the top and sides are needed for air flow.

C. Main Power Connection

2.12 The Model 41-3A operates on 105 to 120 Vac or 215 to 240 Vac, 50 to 60 Hz power. Be sure the rear panel SELECT VOLTAGE switch is correctly positioned for the power source used.

Caution: Two-ampere slow blow fuses, required for 115-volt operation, are installed at the factory in rear panel fuse holders. These fuses must be changed to 1-ampere slow blow fuses if a 230-volt operation is selected.

2.13 The power cord supplied with the unit has a standard NEMA 3-prong, wall-outlet type plug. The other end mates with a 3-prong the unit's rear panel. The Model 41-3A consumes about 60 watts of power.

Note: Besides meeting safety standards, the power cord's NEMA ground pin establishes a common reference between telephone office ground and the 41-3A's chassis ground. Do not modify this connection as it will affect the unit's operation.

D. Verification Procedure

2.14 The following procedures verify the operational status of the Model 41-3A.

2.15 Initial Settings

(1) Place the unit's front panel POWER switch off.

(2) Remove all telephone line connections to the unit.

(3) Release all press-to-engage switches.

(4) Set all timing controls to nominal (12 o'clock) positions.

(5) Set the MODE switch to IDLE.

(6) Set the LEAK/LOOP switches to NORM.

(7) Set the TT/DP/MF switch to TT.

(8) Set the DIALER PROGRAM thumbwheels as follows:

(a) SPEED to 10 (i.e., 10 digits per second)

(b) %BRK to 50 (i.e., 50% tone-on period).

Note: Switch IDT(DP) is not used in these procedures.

(9) Set the RESET/->/NORM switch to NORM.

(10) Set the MASTER and DIALING VOLUME controls to mid-range.

(11) Insert a dummy (not wired) 310-type plug into the front panel LINE CONTROL A jack.

2.16 Check Settings

(1) Set the POWER switch on. The POWER INTERRUPT indicator lights, and all digital readouts display digit 8. Except for the channel A and B TEST, TRACE, and BUSY indicators, all other indicators light.

(2) Press the RESET pushbutton for at least two seconds. The POWER INTERRUPT indicator stops flashing, the TEST RESULTS readout blanks out, and the following indicators light:

(a) Channel A IDLE

(b) Channel B IDLE

(c) PROGRAM ERROR

(d) TEST PROGRESS ON-HOOK (basic unit only)

Note: If the Model 41-3A is equipped with the Expanded Remote Control Option, its TEST PROGRESS IDLE indicator lights instead of the TEST PROGRESS ON-HOOK indicator.

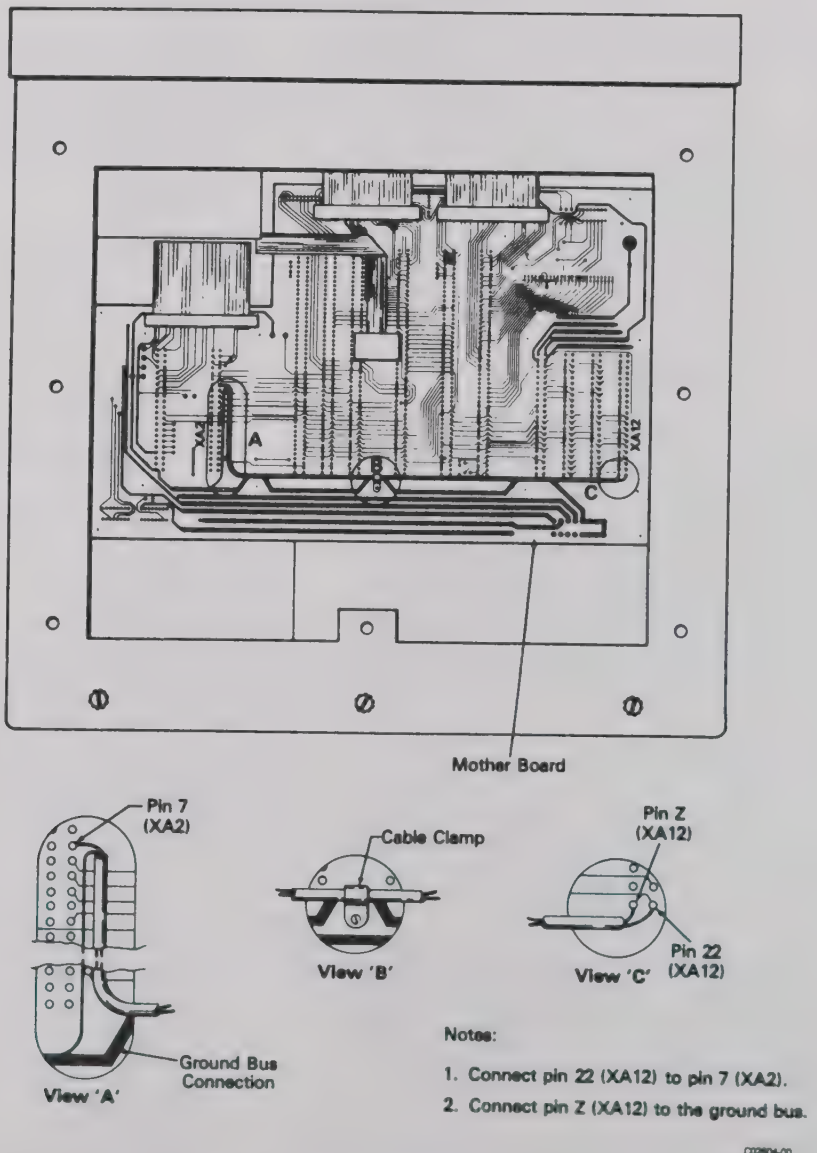


Fig. 9 — Paired Cable

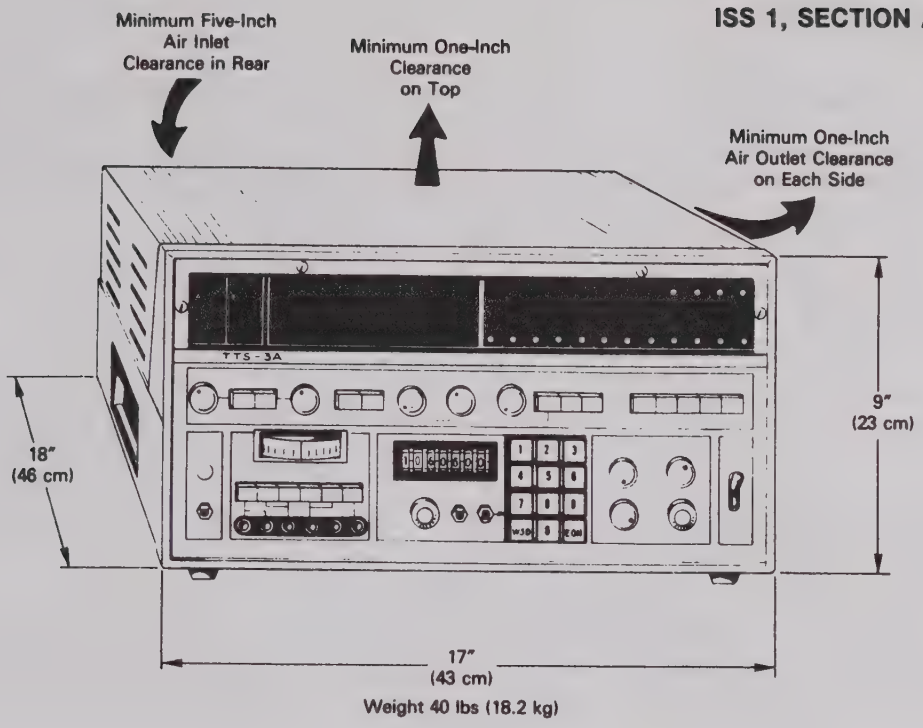


Fig. 10 — Air Flow Requirement

(3) Engage the TEST A, DELAY, and ANS SUP pushbuttons. The PROGRAM ERROR and TEST PROGRESS ON-HOOK indicators go out, and the TEST PROGRESS IDLE indicator lights (basic unit only).

Note: If the Model 41-3A is equipped with the Expanded Remote Control Option, its TEST PROGRESS IDLE indicator remains on.

(4) Set the RESET/– >/NORM switch to RESET, then to – > (load). The TEST PROGRESS readout goes blank.

(5) Use the keyset to enter sequence 1234567890EON into the dialer. The digits are displayed at half brightness in the TEST PROGESS readout.

(6) Set the RESET/– >/NORM switch to NORM.

(7) Ensure that the START AFTER switch is set for 4 seconds.

(8) Engage the FAULT pushbutton.

(9) Set the MODE switch to AUTO. The Model 41-3A places a single test call. After a short pause, the following results occur:

(a) The TEST A indicator lights.

(b) The TEST PROGRESS indicators show the operational status of the 41-3A, and each dialed digit is displayed in full brightness.

(c) Touch-Tone® signals can be heard from the unit's speaker (adjust DIALING VOLUME control as necessary).

(d) The NO ANSWER and SYSTEM HELD indicators light after the DIALING COMPLETED WAITING FOR TEST RESULTS period ends.

(e) The 41-3A emits an alarm tone.

Note: If alarm volume is unsatisfactory, refer to part G (Alarm Volume Adjustment).

(f) The TEST RESULTS readout displays a digit 1.

(10) Hold the NO ANSWER pushbutton depressed. The TEST RESULTS readout shows a digit 1.

(11) Hold the NO DIAL TONE pushbutton depressed. The TEST RESULTS readout goes blank.

(12) If desired, another test call can be placed by momentarily setting the MODE switch to IDLE, then back to the AUTO. Set the POWER switch off when satisfied with the Model 41-3A's performance.

(13) Successful completion of the above steps indicates the Model 41-3A has been shipped without internal damage and is operational.

2.17 Alarm Volume Adjustment

2.18 The following adjustment should be made only if the alarm volume is unsatisfactory.

(1) Set the POWER switch off.

(2) Remove the Model 41-3A's top cover by removing a retaining screw on each side of the unit's rear corners.

(3) Remove the pc board in card slot 5 and reinsert the board on a suitable extender board.

(4) Remove all telephone line connections from the Model 41-3A and perform the verification procedure of part D above, stopping at step 9 of the check settings.

(5) Refer to Fig. 11 and adjust the alarm volume potentiometer until the volume is statisfactory.

(6) Set the MODE switch to IDLE.

(7) Switch POWER to off and replace board 5 in its card slot.

(8) Replace the unit's top cover.

E. Telephone Line Connections

2.19 As shown in Fig. 12, up to 16 telephone lines can be connected to the Model 41-3A's rear panel. Telephone lines can be either 600 or 900 ohm, wet-loop type, T/R or T/R/S circuits, connected via standard 310 type jacks, or 25-pair connector.

2.20 Telephone line connections are normally distributed evenly between channels A and B. This allows continued testing on the other channel while one channel is held for troubleshooting. Table 11 shows the circuit interconnections for the 25-pair connector.

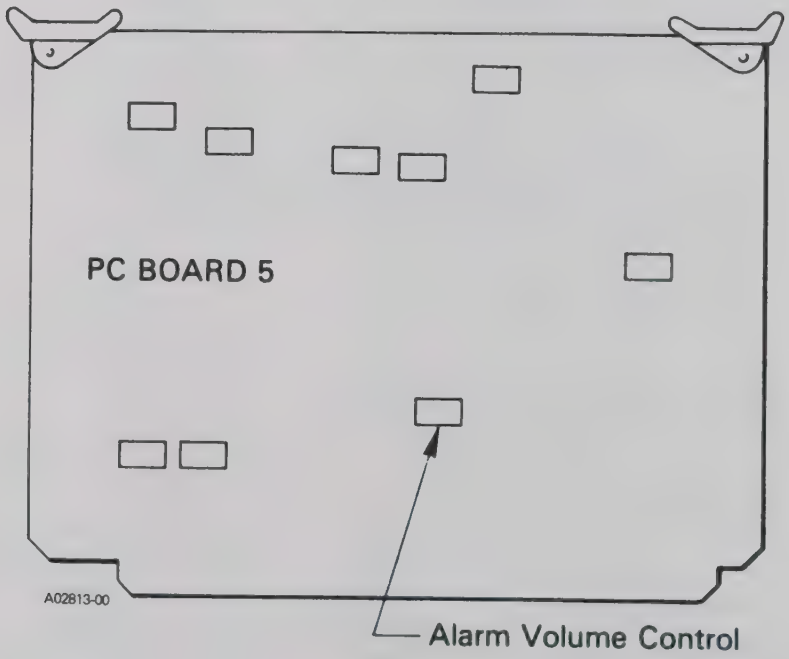


Fig. 11 — Alarm Volume Adjust Control

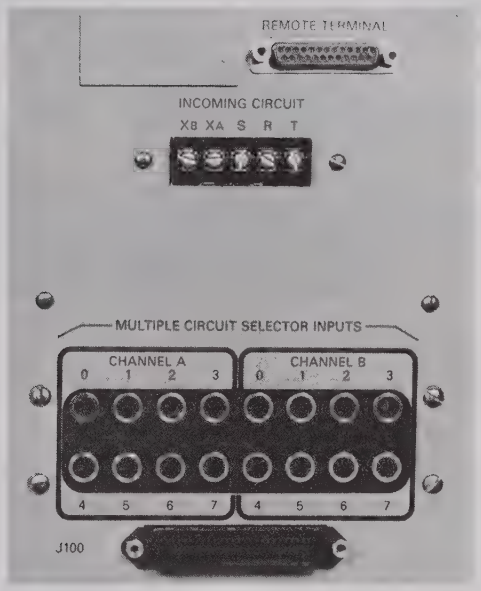


Fig. 12 — Telephone Line Connectors

2.21 Two front panel 310 type jacks are also provided. When a telephone line is connected to either of these jacks, the rear panel jack field is disabled.

2.22 When the Model 41-3A's internal test line is used, an incoming circuit must be connected to the rear panel INCOMING CIRCUIT terminals (see Fig. 12 above). These connections can be T/R, T/R/S, or S only.

2.23 When tripped to off-hook by a 20 to 60-Hz ringing signal, the internal test line couples an internal 1-kHz tone source across the T/R leads of the incoming circuit.

2.24 Test Lead Strapping

2.25 The internal test line is factory-wired for operation with T/R/S or T/R circuit connections. The completion of a call to this test line is recognized by the Model 41-3A when it detects a ringing signal while the S lead is open, grounded, or at a potential more positive than –7 Vdc. Even when ringing is detected, the 41-3A does not consider a call completed if a potential more negative than –11 Vdc is present on the S lead.

2.26 If it is necessary to operate the Model 41-3A with only an S lead connection to the incoming circuit, the factory strapping must be changed. The following steps enable the 41-3A to recognize completed calls with only an S-lead connection.

(1) Remove the unit's top cover by removing a retaining screw on each rear corner.

(2) Refer to Fig. 13 and locate the incoming circuit pc board (96826) which is mounted on the unit's left rear panel.

(3) Cut the board's pc connection between terminals A and C and install a jumper between terminals B and C.

(4) Replace the unit's top cover.

2.27 When strapped for operation with only an S-lead connection to the incoming circuit, the Model 41-3A recognizes a completed call when the S lead is open, grounded, or more positive than –7 Vdc. The 41-3A considers a call completed if a potential more negative than –11 Vdc is present on the S lead.

2.28 Tip/Ring Polarity Check

2.29 After the above telephone line connections are completed, a check is necessary to ensure the Model 41-3A's compatibility with the tip/ring polarity of the call origination lines. This check is performed as follows.

(1) Engage both TEST A and B pushbuttons.

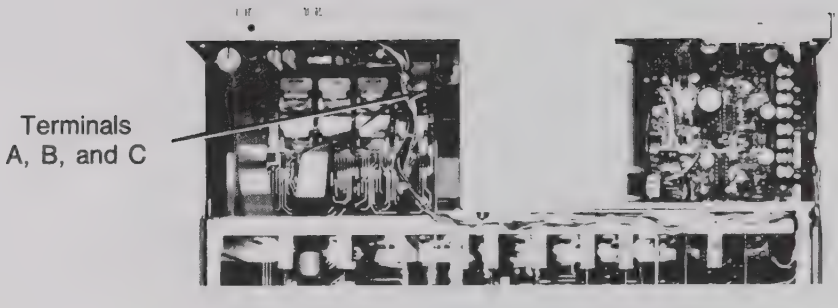


Fig. 13 — Test Line Strap

Note: When a single front panel telephone line connection is used, engage only the corresponding TEST A or B pushbutton.

(2) Engage both DELAY and ANS SUP pushbuttons.

(3) Set the MODE switch to IDLE.

(4) Set the POWER switch to on.

(5) Press the RESET pushbutton for at least two seconds. Wait for the Model 41-3A to find an idle call origination line. The idle line number is indicated in the LINE DISPOSITION display.

(6) Observe the front panel LINE CONTROL meter. When this meter reads almost full scale to the right (NORMAL), the Model 41-3A's polarity is compatible with the tip/ring polarity of the call origination lines; no further action is required other than proceeding to step 10. If the meter reads almost full scale to the left (REVERSE), the Model 41-3A's polarity must be changed; go to step 7.

Note: Some loop trunks are in the off-hook state when idle. If this type of trunk is used and the meter reads almost full scale to the left (REVERSE), the Model 41-3A's polarity is compatible; go to step 10. If the meter reads almost full scale to the right (NORMAL), go to step 7.

(7) Remove the unit's top cover by removing a retaining screw on each rear corner.

(8) Refer to Fig. 14 to locate the unit's internal tip/ring polarity switch.

(9) Set the polarity switch so that the line control meter reads almost full scale to the right. (If the off-hook loop trunks are used, set the polarity switch so that the line control meter reads almost full scale to the left.)

(10) Set the POWER switch off and replace the Model 41-3A's top cover. The tip/ring polarity check is complete, and the unit is ready for operation.

F. External Cable Connections

2.30 In addition to power and telephone line connections to the Model 41-3A, external cable connections to the REMOTE TERMINAL jack are also required when the 41-3A is not operated directly from its own front-panel controls. The Model 41-3A with ERC may be operated from a keyboard terminal or computer device through a modem interface or a local cable connection. The user's equipment configuration, therefore, determines what type of cable connection is made to the REMOTE TERMINAL jack.

2.31 Table D below lists the port characteristics of the Model 41-3A with ERC and associated products. Table E provides pin identification for the REMOTE TERMINAL connector. Notice that the REMOTE TERMINAL port presents a 20-mA current loop interface and an RS-232-C interface on a DCE (data communications equipment) type female connector. For either interface, an asynchronous serial ASCII format is required.

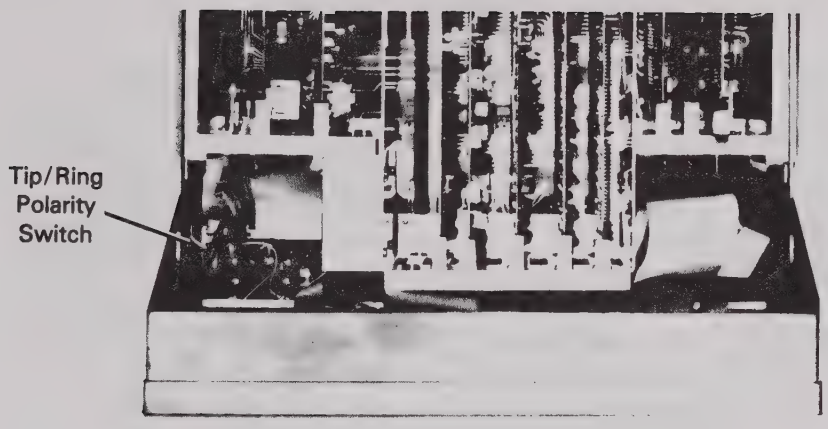


Fig. 14 — Tip/Ring Polarity Switch

2.32 The special null modem interconnection cable shown in Fig. 15 is provided in the ERC Option kit. Notice that the null modem cable does not connect pin-for-pin; instead, pins 2 and 3 of this cable are cross-connected. When mated with the REMOTE TERMINAL jack, the null modem cable converts the jack's DCE interface to a data terminal equipment (DTE) interface. The null modem cable can also function as a DTE-to-DCE interface converter; therefore, it is available as an interface cable for both DCE-to-DCE and DTE-to-DTE type situations. Figure 16 illustrates a typical application of the null modem cable as a DCE-to-DCE interface.

2.33 The null modem cable is designated as Cable 1. Other RS-232-C cable assemblies are available when user equipment includes a 5900-00-910/911 video terminal and a 5900-00-920/921 cassette tape drive. The video terminal is supplied with a male-to-male cable (Cable 2), and the tape drive is supplied with a male-to-female cable (Cable 3). Cables 2 and 3 both function as DCE-to-DTE connectors as shown in Fig. 17 and 18.

TABLE D

PRODUCT INTERFACING

PRODUCT	JACK	SEX	DCE/DTE
Model 41-3A w/ERC	REMOTE TERMINAL	female	DCE
Video Terminal (5900-00-910/911)	EIA/C.L.	female	DTE
Cassette Tape Drive (5900-00-920/921)	MODEM	male	DTE
	TERMINAL	female	DCE

TABLE E

REMOTE TERMINAL PIN IDENTIFICATION

PIN	41-3A FUNCTION	RS-232-C SIGNAL NAME
1	ground	Protective Ground
2	input port	Transmitted Data
3	output port	Received Data
4	input (ignored)	Request To Send (RTS)
5	+12 V output (470 ohms)	Clear To Send (CTS)
6	+12 V output (470 ohms)	Data Set Ready (DSR)
7	ground	Signal Ground (common return)
8	+12 V output (470 ohms)	Received Line Signal Detector
20	input (ignored)	Data Terminal Ready (DTR)
11	+ input	\
13	- input	> 20 mA LOOP
14	+ output	
16	- output	/

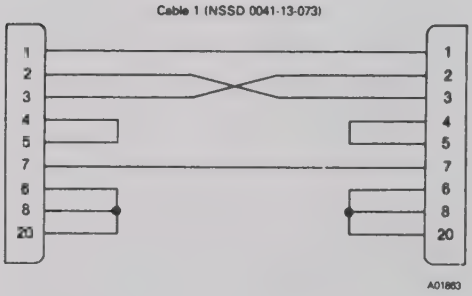


Fig. 15 — Null Modem Cable

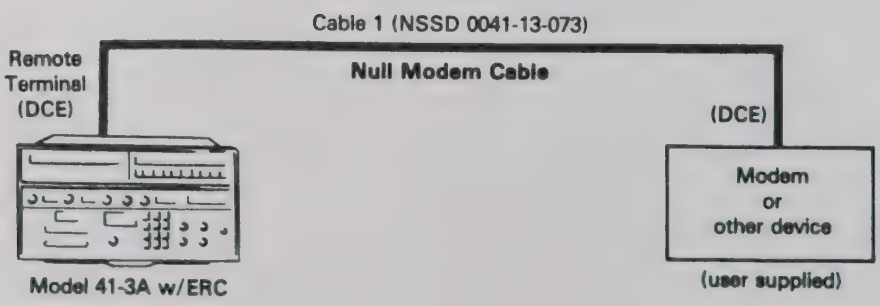


Fig. 16 — Typical Null Modem Cable Connection

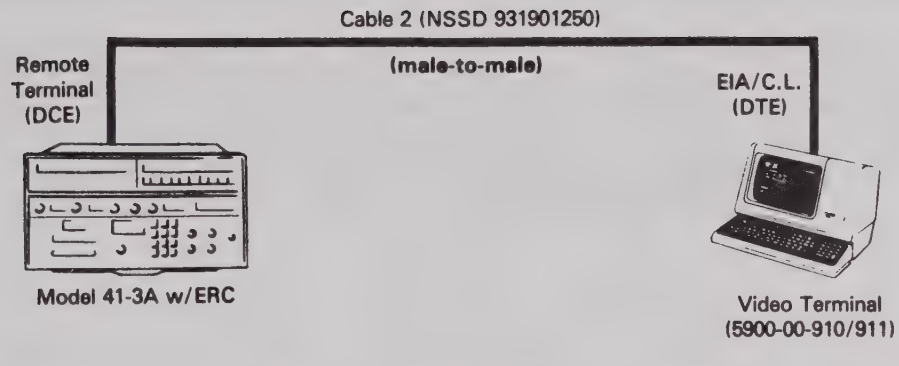


Fig. 17 — Local Terminal Connection

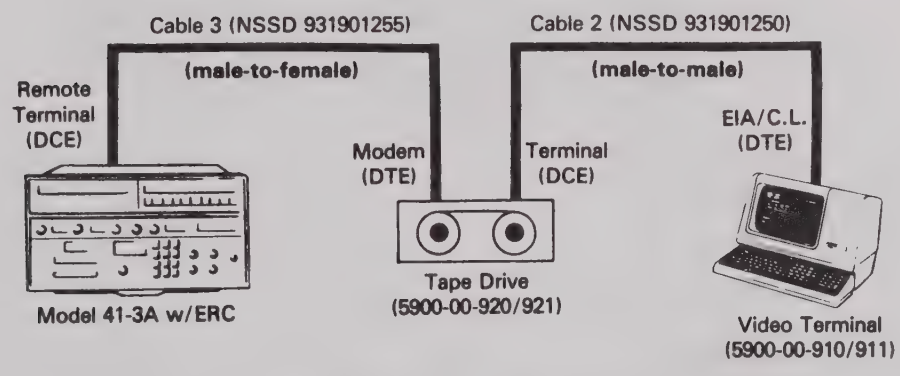


Fig. 18 — Local Terminal and Tape Drive Connections

G. External Control Requirements

2.34 Baud Rates

2.35 All products used in a 41-3A system configuration must operate at the same baud rate. The baud rate of the Model 41-3A with ERC is factory set at 1200 baud. Refer to Fig. 2 when resetting the baud rate switch on the TTY Interface Board.

Note: Always remove the Model 41-3A's input power cord before removing its top cover or removing circuit boards from its card cage.

2.36 The 5900-00-910/911 terminal has bit switches mounted on its rear panel for selecting baud rate. Set-up switches (DYS-10 and DYS-8) are factory preset as shown by Fig. 19.

2.37 The baud rate selector for the 5900-00-920/921 tape drive is found on its front panel.

Note: The NED 5900-00-920/921 tape drive (or equivalent) is the only cassette tape drive unit recommended for use with the Model 41-3A with ERC.

2.38 After all product baud rates are adjusted, cycle power at the terminal.

2.39 Model 41-3A Settings

2.40 The remote control option enables an operator to store a program of instructions within the Model 41-3A's internal memory. The stored program usually contains control instructions which override many of the Model 41-3A's front panel switch settings. However, there are certain control functions which remain independent of the remote control option programming. In addition to the POWER switch, the following designated potentiometers and thumbwheels must be preset in accordance with manual A0041-13-606/600 (Model 41-3A Central Office Service Analyzer) and the user's application.

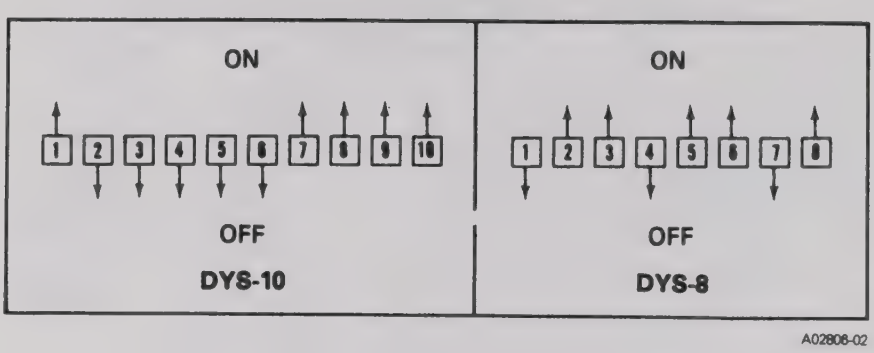


Fig. 19 — Switch Positions for Terminal 5900-00-910/911

- **SYSTEM TIMING & MON:**
  - **NETWORK DLY**
  - **TEST OK TIME**
  - **RECYCLE PERIOD**
  - **DIALING/MASTER VOLUME**
- **START DIAL COMMAND:**
  - **START AFTER**
  - **FAULT AFTER**
- **DIALER PROGRAM:**
  - **SPEED**
  - **% BRK**
  - **IDT (DP)**
- **LOOP/LEAK:**
  - **(inner and outer knobs)**

Note: To ensure a correct test response, set the NETWORK DLY time at approximately 15 seconds for 1-kHz tone or C-message noise measurements.

2.41 Unless otherwise directed by a stored instruction, the Model 41-3A defaults to its panel control settings. A program error may then halt a dialing operation if the following panel switch conditions are not observed:

- One or both START DIAL COMMAND pushbuttons (DELAY or DIAL TONE) must be depressed.
- One or more TEST OK ON pushbuttons (1KHZ TONE, ANS SUP, or INC CKT) must be depressed.
- One or more LINE CONTROL TEST pushbuttons (TEST A or TEST B) must be depressed.

2.42 Terminal Equipment Settings

2.43 When user equipment includes a 5900-00-910/911 video terminal the CAPS LOCK key of its keyboard must be latched on.

2.44 When a 5900-00-920/921 tape drive is used, the ON LINE switch (as well as the power switch) of the tape drive must be on (up position); the remaining front panel switches must be off.

3. OPERATION VIA FRONT PANEL CONTROLS

3.01 The basic features of any Model 41-3A can be used via its front panel controls. Special features provided by the Remote Control and associated options can be used only when the 41-3A is operated as explained in Section 4 of this manual.

A. Controls, Indicators, and Connectors

3.02 Reference designators for all front panel controls and indicators as well as rear panel connectors are given in Fig. 20 and 21. These reference designators are used in Table F which provides brief functional descriptions of the various defined controls, indicators, and connectors.

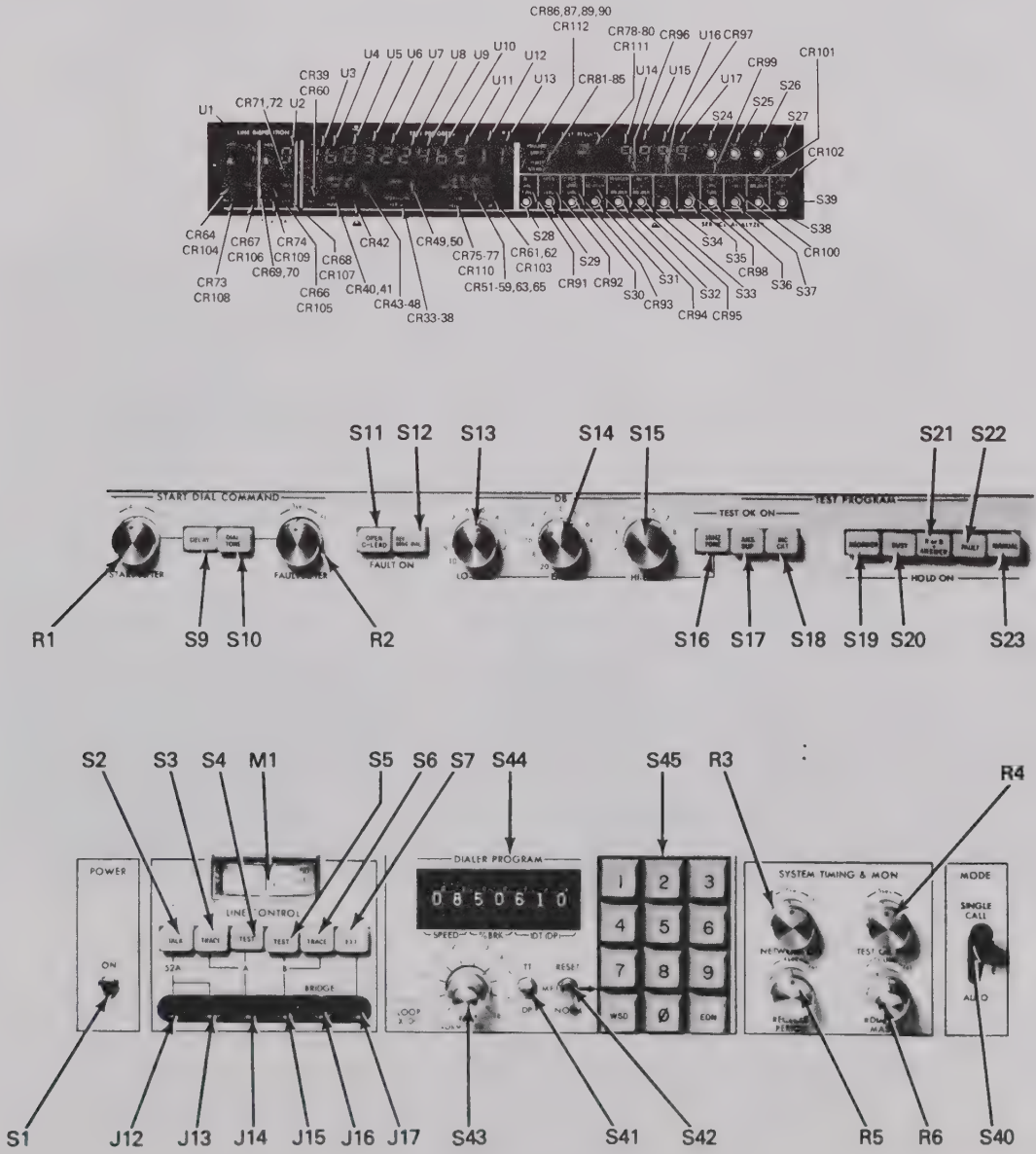


Fig. 20 — Front Panel Controls and Indicators

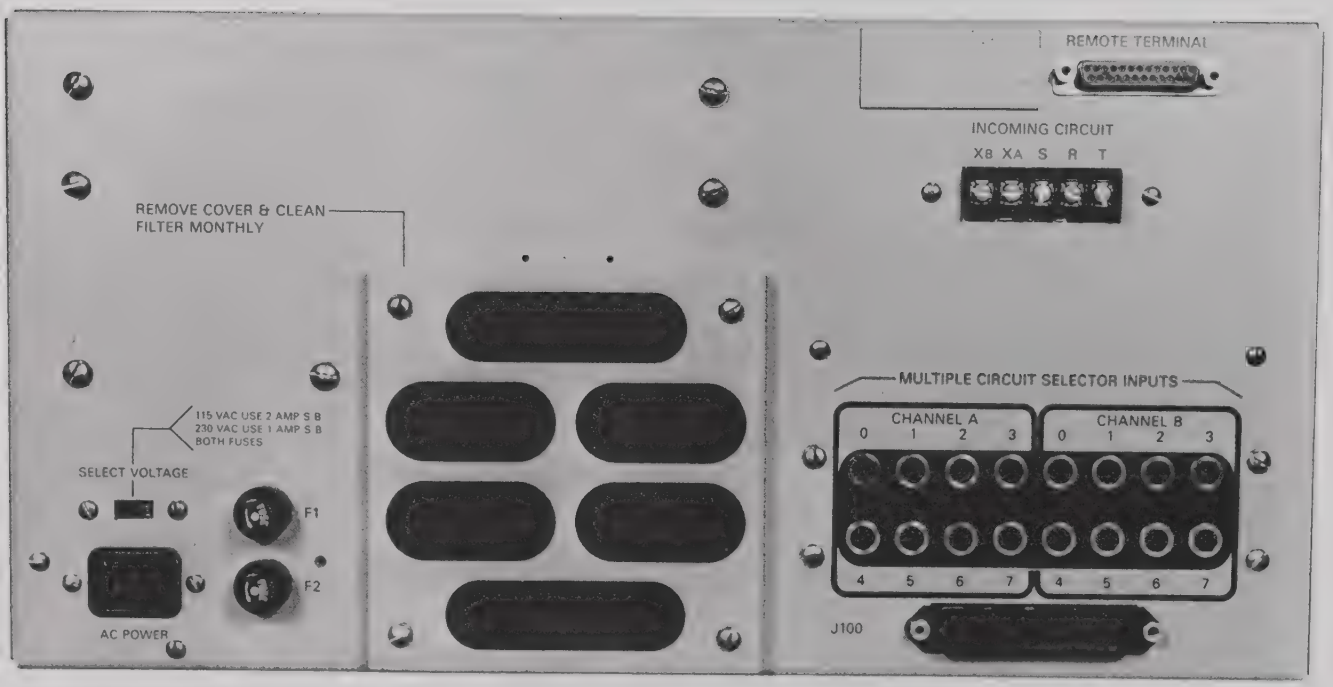


Fig. 21 — Rear Panel Connectors

TABLE F

CONTROLS, INDICATORS, AND CONNECTORS

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
POWER/LINE CONTROL GROUP		
J12/J13	52A	Allows use of a 52A headset for voice communication on selected line (if TALK pushbutton is engaged).
J14	A	For convenience, allows front panel connection of a single originating line (T/R or T/R/S) to the unit's channel A. The rear panel jack field is automatically disconnected when the A jack is used.
J15	B	For convenience, allows front panel connection of a single originating line (T/R or T/R/S) to the unit's channel B. The rear panel jack field is automatically disconnected when the B jack is used.
J16	BRIDGE	Allows T/R/S bridging connections to the selected call originating line. The line's internal connections to detection, holding, and dialing circuits are not broken when the BRIDGE jack is used. *Note:* Making level measurements (or similar tests) with external equipment via the BRIDGE jack is not recommended since the analyzer's 735-ohm termination will affect the results. The EXT jack can be used for this purpose as described in section 3.55.
J17	EXT	Allows T/R/S terminating connections to the selected call originating line (only when EXT pushbutton is engaged). Engaged EXT pushbutton S7 breaks the line's internal connections to detection, holding, and dialing circuits. The Ext pushbutton is a break-before-make type. To use the EXT jack with external test equipment without releasing the line under test, refer to section 3.55.
M1	LINE CONTROL	Indicates dc voltage of normal or reverse polarity present on the selected call originating line.
S1	POWER	ON position applies ac power to the unit.
S2	TALK	When engaged, allows a 52A headset to be used for voice communication on the selected call originating line. The 52A headset connects to the 52A jacks. Engaged TALK switch S2 disables the monitor amplifier.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
POWER/LINE CONTROL GROUP (Cont'd)		
S3	TRACE A	When engaged, places a trace tone on a selected channel A line and holds the line off-hook. Engaged TRACE A pushbutton S3 disables operation of the channel A line selector and lights the TRACE A indicator. Engaged TRACE A pushbutton S3 does not inhibit tests on channel B.
S4	TEST A	When engaged, programs the unit to perform tests on channel A.
S5	TEST B	When engaged, programs the unit to perform tests on channel B. *Note:* If both TEST pushbuttons are engaged and all lines are idle, test calls will alternate between channel A and channel B. (Busy lines and empty rear panel circuit selector jacks are automatically bypassed.) Also, at least one TEST pushbutton must be engaged to avoid a program error condition.
S6	TRACE B	When engaged, places a trace tone on a selected channel B line and holds the line off-hook. Engaged TRACE B pushbutton S6 disables operation of the channel B line selector and lights the TRACE B indicator. Engaged TRACE B pushbutton S6 does not inhibit tests on channel A.
S7	EXT	When engaged, connects the EXT jack to the selected call originating line. Engaged EXT pushbutton S7 breaks the line's internal connections to detection/dialing/holding circuits, and presents the EXT jack to the line in a terminating configuration. Switching is break-before-make type.
DIALER GROUP		
S41	TT/DP/MF	Selects Touch-Tone® dialing when placed in the TT position. Selects dial pulsing when placed in the DP position. The MF position selects multifrequency dialing.
S42	Reset/-->/NORM	When at RESET, blanks Test PROGRESS readout U3-U13 except when unit is off-hook. The --> (load) position enables entering of a number to be dialed via the keyset. Both the RESET and --> (load) positions result in a program error unless MODE switch is at IDLE. The NORM position allows the MODE switch to be moved from IDLE without producing a program error.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
DIALER GROUP (Cont'd)		
S43	LEAK/LOOP	Sets leak impedance and loop resistance for dial pulsing. The LEAK (inner) control selects the leak impedance to be shunted across the line under test during dial pulsing. The LOOP (outer) control selects a loop resistance to be placed in series with the line under test during dial pulsing. Tables C and D list the values of leak the values of leak impedance and loop resistance that can be selected with the LEAK/LOOP control. *Note:* It is not typical practice to use both leak impedance and loop resistance at the same time.
S44	DIALER PROGRAM	The SPEED thumbwheels set (from 1 to 99) the number of pulses per second for dial pulsing, or the number of digits per second for Touch-Tone® or multifrequency dialing. The % BRK thumbwheels set (from 1 to 99) the percent break for dial pulsing or the duty cycle (tone-on period) for Touch-Tone® or multifrequency dialing. The IDT thumbwheels set the interdigital time from 1 to 999 milliseconds for dial pulsing only.
S45	KEYSET	Allows entry of a number to be dialed, but only when RESET/-->/NORM switch is at --> (load). The WSD (wait-for-start-dial) key may be used to program waits for additional dial tone (or optional wink) or start dial delay between any digits of the number to be dialed. The EON (end-of-number) key must be pressed after entering all digits of the number to be dialed.
SYSTEM TIMING/MODE GROUP		
R3	NETWORK OLY	Sets the maximum time allowed to obtain a TEST OK indication from approximately 2 to 60 seconds after completion of dialing. Faults are recorded in the apropriate test categories if the test program is not satisfied and a busy or reorder tone is not detected during this time interval. This control is typically set for 15 seconds.
R4	TEST OK TIME	Sets the minimum time duration that a satisfactory test result must be present before a TEST OK is recorded. Can be set from approximately 2 to 8 seconds. This control is typically set for 5 seconds.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
SYSTEM TIMING/MODE GROUP		
R5	RECYCLE PERIOD	Sets the minimum time period the unit will be on-hook between test calls. RECYCLE PERIOD can be set for 2 to 8 seconds and is typically set for 4 seconds.
R6	DIALING/MASTER VOLUME	MASTER (outer) control sets monitor output volume at all times except when unit is dialing, on-hook, or when a 52A headset is in use. DIALING (inner) control sets monitor output volume when unit is dialing. Monitor output is disabled when a 52A headset is in use or when unit is on-hook.
S40	MODE	IDLE position places the unit on-hook and lights the IDLE indicator. AUTO position allows repetitive test calling as programmed, except when a system hold is encountered. SINGLE CALL position instructs the unit to remain off-hook (a system hold) after placing a single test call. To avoid a program error when MODE switch is moved from IDLE position, the RESET/-->/NORM switch must be in the NORM position.
START DIAL GROUP		
R1	START AFTER	Sets the delay time before dialing is begun. The delay setting is typically 3 seconds, and can be varied from approximately 2 to 8 seconds.
R2	FAULT AFTER	Sets the maximum time allowed for detection of dial tone or a wink-type start dial signal prior to dialing. If a valid start dial signal is not detected during this fault-after period, a no dial tone fault is recorded and the NO DIAL TONE indicator lights. The fault after setting is typically 4 seconds, and can be varied from approximately 1 to 7 seconds.
S9	DELAY	When engaged, programs the unit to wait for the START AFTER control delay to expire before dialing.
S10	DIAL TONE	When engaged, programs the analyzer to wait for a start dial signal (dial tone or wink) before dialing. The maximum wait time is determined by the FAULT AFTER setting. If a valid start dial signal is not detected during the fault-after period, a no dial tone fault is recorded and the NO DIAL TONE indicator lights.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
START DIAL GROUP (Cont'd)		
S15 (Cont'd)		*Note:* Both the DELAY and DIAL TONE pushbuttons can be engaged when desired. This program conditions the unit to: (a) begin dialing when dial tone (or wink) is received after initial off-hook, and if WSD commands are entered into the dialer, to (b) resume dialing after the START AFTER delay expires. (Detecting neither dial tone nor wink within time allowed after initial off-hook produces a no dial tone fault.) Also, at least one of the START DIAL COMMAND pushbuttons must be engaged to avoid a program error.
TEST PROGRAM GROUP		
S11	OPEN C-LEAD	When engaged, programs the unit to record an open C-lead fault and lights the OPEN "C" LEAD indicator if an open C-lead is detected.
S12	REV ORNG-DIAL	When engaged, and while dialing DP, this switch programs the unit to record as a fault any tip/ring polarity reversal which occurs during dialing. The REV DRNG DIAL indicator lights if the unit detects this condition. No tip/ring reversals are detected if the unit is programmed to dial MF or DTMF.
S13	LO-LIMIT	Sets the minimum acceptable level of a detected 1-kHz tone with respect to programmed EML (S14). If the level of a detected 1-kHz tone is less than the EML setting by an amount greater than the LO-LIMIT setting (in dB), a low level fault is recorded and the LO-LEVEL indicator lights. The 1KHZ TONE pushbutton must be engaged to enable this function.
S14	EML	Sets the expected measured level (in – dBm) of a 1-kHz tone to be detected. If a detected 1-kHz tone varies from the EML setting by an amount outside upper and lower limits (set by LO-LIMIT S13 and KI-LIMIT S15) a fault is recorded in the appropriate category and the appropriate indicator lights. If no 1-kHz tone above –31 dBm is detected during NET WORK OLY (R3) time period following dialing, then the NO 1KHZ TONE message lights and the fault is recorded. The 1KHZ TONE pushbutton must be engaged to enable this function. *Note:* The expected level will be as selected by the EML control for both 600 and 900-ohm circuits.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST PROGRAM GROUP		
S15	HI-LIMIT	Sets the maximum acceptable level of a detected 1-kHz tone with respect to programmed EML (S14). If a detected 1-kHz tone exceeds the EML setting by an amount greater than the HI-LIMIT setting (in dB), a high level fault is recorded and the HI LEVEL indicator lights. The 1KHZ TONE pushbutton must be engaged to enable this function.
S16	1KHZ TONE	When engaged, programs the unit to record a no 1-kHz tone fault and light NO 1KHZ TONE indicator if the unit fails to detect a 1-kHz tone within the NETWORK OLY (R3) time period after dialing. The level of a 1-kHz tone must be greater than –31 dBm (from either 600 or 900-ohms) to be detected. The unit also determines if the 1-kHz tone level varies from the EML control S14 setting by an amount outside upper and lower limits set by LO-LIMIT controls S13 and HI-LIMIT control S15. If either limit is exceeded, an appropriate fault is recorded and the corresponding indicator lights.
S17	ANS SUP	When engaged, programs the unit to record a no answer fault and to light the NO ANSWER indicator if tip/ring polarity reversal (answer) did not occur within the NETWORK OLY (R3) time period after dialing.
S18	INC CKT	When engaged, programs the unit to receive a test call via its internal test line. If the internal test line fails to detect a call within the NETWORK OLY (R3) time period after dialing, an incoming circuit fault is recorded and the INC CKT FAULT indicator lights. *Note:* At least one of the following switches must be engaged to avoid a program error: 1KHZ TONE S16, ANS SUP S17, and INC CKT S18.
S19	HOLD ON REORDER	When engaged, will cause unit to stop automatic recycling and remain off-hook if reorder tone is detected and false tip/ring polarity reversal (answer) is not detected. Both REORDER and SYSTEM HELD indicators light when this condition occurs.
S20	HOLD ON BUSY	When engaged, will cause unit to stop automatic recycling and remain off-hook if busy tone is detected and false tip/ring polarity reversal (answer) is not detected. Both BUSY and SYSTEM HELD indicators light when this condition occurs.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST PROGRAM GROUP (Cont'd)		
S21	HOLD ON R OR B + ANSWER	When engaged, will cause unit to stop automatic recycling and remain off-hook if false tip/ring polarity reversal (answer) is detected and either busy or reorder tone is also detected. SYSTEM HELD indicator and either REORDER + ANSWER indicator or BUSY + ANSWER indicator will light when this condition occurs.
S22	HOLD ON FAULT	When engaged, will cause the unit to stop automatic recycling and remain off-hook if any fault (not busy or reorder tone) is detected. The SYSTEM HELD indicator and either REORDER + ANSWER indicator or BUSY + ANSWER indicator will light when this condition occurs.
S23	HOLD ON MANUAL	When engaged, will cause the unit to stop automatic recycling and remain off-hook after completing the current test. The SYSTEM HELD indicator lights when this pushbutton is engaged. Also, the unit's alarm tone is disabled if a HOLD ON MANUAL is selected.
LINE DISPOSITION GROUP		
CR64 CR104	TEST A	Lights to indicate unit has gone off-hook after selecting an idle channel A line.
CR66 CR105	TEST B	Lights to indicate unit has gone off-hook after selecting an idle channel B line.
CR67 CR106	IDLE A	When lit indicates the selected channel A line is idle (i.e., sleeve lead open circuit or more negative than –11V).
CR68 CR107	IDLE B	When lit indicates the selected channel B line is idle (i.e., sleeve lead open circuit or more negative than –11V).
CR69 CR70	TRACE A	Lights when the TRACE A pushbutton is pressed. Indicates a tracing tone is present on the selected channel B line.
CR71 CR72	TRACE B	Lights when the TRACE B pushbutton is pressed. Indicates a tracing tone is present on the selected channel B line.
CR73 CR108	BUSY A	When lit indicates the selected channel A line is busy, (i.e. the sleeve lead is at ground potential or more positive than –7V).
CR74 CR109	BUSY B	When lit indicates the selected channel B line is busy, (i.e. the sleeve lead is at ground potential or more positive than –7V).

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
LINE DISPOSITION GROUP		
U1	CHAN A	Indicates the number of the selected channel A line.
U2	CHAN B	Indicates the number of the selected channel B line.
TEST PROGRESS GROUP		
CR33-38	INTER—DIGITAL PERIOD	Lights during time interval between dialing digits only when unit is dial pulsing.
CR39 CR60	IDLE	Lights to indicate unit is on-hook when the MODE switch is in the IDLE position.
CR40 CR41	ON HOOK	Lights to indicate unit is on-hook when the MODE switch is in the AUTO or SINGLE CALL position.
CR42	TTY	Not used in basic Model 41-3A unit. Provided for use in conjunction with the expanded remote control option.
CR43-48	WAITING FOR START DIAL	When lit indicates: 1. Unit is waiting for a programmed delay to expire before dialing if the DELAY pushbutton is depressed. 2. Unit is waiting for dial tone (or wink-type start dial signal) before dialing if the DIAL TONE pushbutton is depressed. 3. If both DELAY and DIAL TONE are engaged, this message is displayed after initial off-hook to indicate unit is waiting for 2 above before dialing. If WSO command(s) are encountered during the dialing process, this message is displayed again to indicate unit is waiting for 1 above before resuming the dialing.
CR49 CR50	DIALING	When lit indicated unit is sending dialing signaling (either Touch-Tone,® dial pulse, or multifrequency).
CR51-59 CR63 CR65	DIALING COMPLETED WAITING FOR TEST RESULTS	Lights when dialing is completed. Remains lit until unit determines results of test program.
CR61-62 CR103	TEST OK	Lights to indicate that a test call encountered none of the faults unit is programmed to detect. Remains lit until current test cycle is completed and unit returns to on-hook.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST PROGRESS GROUP (Cont'd)		
CR75-77 CR110	SYSTEM HELD	Lights if, for any reason, unit is not automatically recycling.
U3-13	TEST PROGRESS	Displays digits of the number to be dialed. Digits are displayed at half brightness when entered via the keyset. Each digit is brought up to full brightness when dialed out by the unit.
TEST RESULTS GROUP		
CR78-80 CR111	OVER RANGE	Lights when total tests category exceeds a count of 9999. To remove the over-range indication, the RESET pushbutton is pressed with MODE switch in IDLE position. This action also resets all test result categories to zero.
CR81-85	POWER INTERRUPT	Flashes to indicate unit's power has been momentarily removed. The OFF (down) to ON transition of the POWER switch also causes this indicator to flash. When the power interrruption indication occurs, the PROGRAM ERROR indicator lights and the unit is held on-hook. To remove power interrupt indication, depress RESET pushbutton with MODE switch in IDLE position for at least 2 seconds. The dialing number must be reprogrammed after a power interrupt occurs.
CR86 CR87 CR89 CR90 CR112	PROGRAM ERROR	Lights to indicate incorrect operation of the unit. A program error occurs when a test program is incorrect, or insufficient, or MODE switch is removed from IDLE position while RESET/-- >/NORM switch is in the --> (load) or RESET positions. A program error indication also occurs when a power interrupt condition exists. Unit remains on-hook until program error is corrected.
CR91	NO DIAL TONE	Lights to indicate dial tone (or wink start dial) was not returned on the selected line within programmed FAULT AFTER (R2) time period. The DIAL TONE pushbutton must be engaged to detect this condition.
CR92	OPEN "C" LEAD	When lit indicates C-lead open circuit or potential more negative than the -11 volts occurred during dialing or while test results were being determined. To detect this condition, the OPEN C-LEAD pushbutton must be engaged.
CR93	REV DRNG DIAL	Lights to indicate a tip/ring polarity reversal occurred while dialing. To detect this condition, the REV DRNG DIAL pushbutton must be engaged.
CR94	REORDER + ANSWER	Lights when unit detects reorder tone without false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST RESULTS GROUP (Cont'd)		
CR95	RECORDER + ANSWER	Lights when unit detects both reorder tone and false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR96	BUSY + ANSWERS	Lights when unit detects both busy tone and false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR97	BUSY	Lights when unit detects busy tone without false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR98	LO LEVEL	Lights when level of a received 1-kHz tone is less than the threshold level set by combination of EML control S14 and LO-LIMIT control S13. To detect this condition the 1KHZ TONE pushbutton must be engaged.
CR99	NO 1 KHZ TONE	Lights to indicate that a 1-kHz tone having level above –31 dBm (from either 600 or 900 ohms) was not received during NETWORK OLY (R3) time period following completion of dialing. To detect this condition, the 1KHZ TONE pushbutton must be engaged.
CR100	HI LEVEL	Lights when level of received 1-kHz tone is greater than the threshold level set by combination of EML control S14 and HI-LIMIT control S15. To detect this condition, the 1KHZ TONE pushbutton must be engaged.
CR101	NO ANSWER	Lights when unit does not receive a tip/ring polarity reversal (answer) within NETWORK OLY (R3) time period following completion of dialing. To detect this condition the ANS SUP pushbutton must be engaged.
CR102	INC CKT FAULT	Lights when unit does not receive a test call placed to its internal test line during NETWORK OLY (R3) time period following completion of dialing. To detect this condition, the INC CKT pushbutton must be engaged.
S24	RESET	When pressed, resets counts in all test result categories to zero, also removes any power interrupt and over-range indications. Reset can occur only when the MODE switch is in the IDLE position. *Note:* To remove the POWER INTERRUPT indication, the RESET pushbutton should be pressed for at least 2 seconds.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST RESULTS GROUP (Cont'd)		
S25	OK	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests which resulted in a test OK.
S26	A	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests attempted on channel A.
S27	B	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests attempted on channel B.
S28	NO DIAL TONE	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no dial tone (or no wink) faults detected.
S29	OPEN "C" LEAD	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all open C-lead faults detected.
S30	REV DRNG DIAL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tip/ring polarity reversals during dial faults detected.
S31	REORDER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all reorder tone detection without false tip/ring polarity reversal (answer).
S32	REORDER + ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all reorder tone detections which were accompanied by false tip/ring polarity reversal (answer) detections.
S33	BUSY + ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all busy tone detections which were accompanied by false tip/ring polarity reversal (answer) detections.
S34	BUSY	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all busy tone detection without false tip/ring polarity reversal (answer).
S35	LO LEVEL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all low level faults detected.
S36	NO 1KHZ TONE	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no 1-kHz tone faults detected.

TABLE F (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST RESULTS GROUP (Cont'd)		
S37	HI LEVEL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all high level faults detected.
S38	NO ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no answer faults detected.
REAR PANEL GROUP		
S39	INC CKT FAULT	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all incoming circuit faults detected.
U14-U17	TEST RESULTS	Normally displays total count of all tests attempted on both channel A and channel B. The count accumulated in any other test result category is displayed when the appropriate test result pushbutton is pressed.
F1/F2	FUSES	Protect analyzer against excessive input current. Use 2-ampere slow-blow fuses for 115 Vac operation. Use 1-ampere slow-blow fuses for 230 Vac operation.
J18-25	CHANNEL A 0-7	Up to eight telphone lines (T/R or T/R/S) may be connected to this jack field for test call origination via the unit's channel A. Unit scans and selects lines under programs control. Connections are made via 310 type jacks. Any empty jacks appear busy to the unit and are skipped by the line scanning/selection circuits.
J26-33	CHANNEL B 0-7	Up to eight telephone lines (T/R or T/R/S) may be connected to this jack field for test call origination via the unit's channel B. Unit scans and selects lines under program control. Connections are made via 310 type jacks. Any empty jacks appear busy to the unit and are skipped by the line scanning/selection circuits.
J34	POWER	Unit's input power cord connects to this jack.
S48	SELECT VOLTAGE	Configures the unit for either 115 of 230 Vac operation. The proper fuses must be used for each power source as noted on the rear panel.
TB1	INCOMING CIRCUIT	The T,R,S terminals provide tip/ring/sleeve connections to the unit's internal test line. The XA and XB terminals are not used.

B. Programming Instructions

Note: The tip/ring polarity check, given under Section 2 (Installation), is required to ensure proper operation of the Model 41-3A.

3.03 Initial Settings

3.04 Connect the Model 41-3A to a source of ac power and to telephone lines as described under the installation instructions. Then make the following control settings.

(1) POWER switch off

(2) All press-to-engage switches released

(3) LEAK/LOOP switches to NORM

(4) TT/DP/MF switch to DP

(5) RESET/->/NORM switch to NORM

(6) MODE switch to IDLE

(7) SYSTEM TIMING and MON controls to 12 o'clock

(8) START DIAL COMMAND controls to 12 o'clock

(9) DB switches to 12 o'clock

3.05 Power and Reset

3.06 Place the POWER switch on and press the RESET button for at least 2 seconds (see Fig. 22). The Model 41-3A must be reset following the interruption of ac power. The following indicators are lighted at this time:

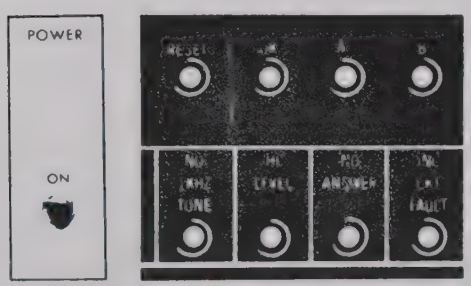


Fig. 22 — Power and Reset Controls

(1) Channel A IDLE

(2) Channel B IDLE

(3) PROGRAM ERROR

(4) TEST PROGRESS ON-HOOK (basic unit only).

Note: If the Model 41-3A is equipped with the Expanded Remote Control Option, its TEST PROGRESS IDLE indicator lights instead of the TEST PROGRESS ON-HOOK indicator.

3.07 Line Control

3.08 The line control is used to determine the placement of test calls on channel A and/or B lines (see Fig. 23). Normally, the two TEST pushbuttons are engaged for testing on both channels. If all lines are idle when two-channel testing is selected, test calls are alternated between channel A and B. (Busy lines and empty rear-panel circuit selector jacks are bypassed.) If call completion data for only one channel is desired, engage the appropriate TEST A or B pushbutton.

Note: One or both TEST pushbuttons must be engaged to avoid a program error condition.

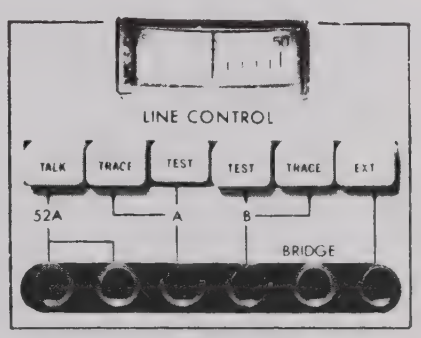


Fig. 23 — Line Controls

3.09 The TRACE pushbutton is used only for troubleshooting and is normally released. Its troubleshooting function is discussed later. The TALK and EXT pushbuttons are also normally released. Explanations of the TALK, EXT, and BRIDGE functions are provided later.

3.10 Test Program

3.11 Test program controls determine what test faults the Model 41-3A is programmed to detect, and under what conditions, if any, the 41-3A halts and holds a line under test for troubleshooting. These programming controls are shown in Fig. 24.

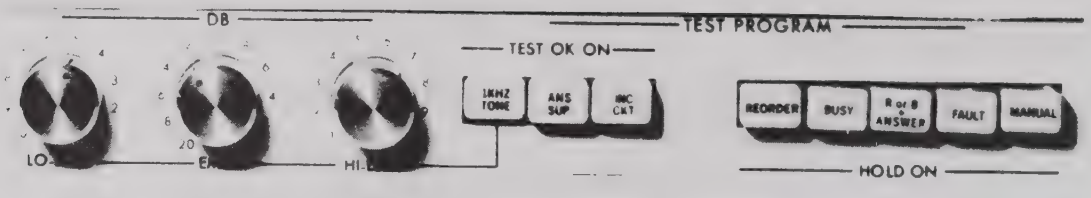


Fig. 24 — Test Program Controls

3.12 All selected tests must be satisfied (no faults detected) before the Model 41-3A records a TEST OK result for a dialed number. Use the following selection steps to program which tests are to be made on the call origination lines.

(1) If detection of an open C-lead fault is desired, engage the OPEN C-LEAD pushbutton.

(2) If detection of a false tip/ring polarity reversal during dialing is desired, engage the REV DRNG-DIAL pushbutton.

(3) If detection of a 1-kHz tone is desired, engage the 1KHZ TONE pushbutton. The 1-kHz tone source can be the 41-3A's built-in test line or another source such as a type 102 test line. After engaging the 1KHZ TONE, use the DB controls to set acceptable upper and lower level limits. The DB controls are set as follows.

(a) Set the EML control to the expected measured level (–20 to 0 dBm). If the 41-3A built-in test line is used, set the EML for 0 dBm minus the estimated loss from telephone equipment.

Note: The expected level will be as selected by the EML control for both 600 and 900–ohm circuits.

(b) Determine an acceptable negative deviation from the EML setting, and set the LO-LIMIT control to the determined dB value.

(c) Determine an acceptable positive deviation from the EML setting, and set the HI-LIMIT control to the determined dB value.

(4) If detection of answer supervision (tip/ring polarity reversal) is desired, engage the ANS SUP pushbutton.

(5) If detection of a call completed to the unit's internal test line is desired, engage the INC CKT pushbutton. For this test, the rear panel INCOMING CIRCUIT terminals must connect to an incoming circuit as explained under the heading Telephone Line Connections, of the installation instruction.

Note: At least one of the 1KHZ TONE, ANS SUP, and INC CKT pushbuttons must be engaged to prevent a program error condition.

3.13 The Model 41-3A can also be programmed to halt a dialing operation and to hold a line under test for troubleshooting. Use the following selection steps to program one or more HOLD ON conditions.

(1) Engage the REORDER button to hold a line on which a reorder tone (without a false tip/ring reversal) is detected.

(2) Engage the BUSY button to hold a line on which a busy tone (without a false tip/ring reversal) is detected.

(3) Engage the R OR B + ANSWER button to hold a line on which both a false tip/ring reversal (answer) and either a reorder or busy tone is detected.

(4) Engage the FAULT button to hold a line on which any fault is detected. A fault is detected when the test program is not satisfied, or when a dial tone (or a wink) signal is absent or late. A detected busy/reorder hold condition is not recorded as a fault.

(5) The MANUAL hold button is normally released, and is engaged only if it is necessary to manually hold a line under test.

3.14 System Timing & Monitor

3.15 The four system timing and monitor controls shown in Fig. 25 are used to adjust the Model 41-3A's overall timing and audio volume.

3.16 The NETWORK DLY control sets the maximum time allowed to obtain a TEST OK after completion of dialing. The time can be set from approximately 2 to 60 seconds. If the test program is not satisfied and a busy or reorder tone is not detected within the network delay time, a fault is recorded in the appropriate category. ***A typical setting for this is 15 seconds.***

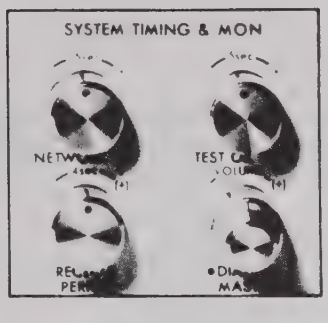


Fig. 25 — System Timing & Monitor Controls

3.17 The RECYCLE PERIOD control sets the minimum on-hook period between test calls. This control permits adjustment from approximately 2 to 8 seconds. At the end of this period, the Model 41-3A finds the next idle line and dials the next test call. ***A typical period control is 4 seconds.***

3.18 The TEST OK TIME control sets the minimum time a satisfactory test result must remain present before a TEST OK can be recorded. This control can be set from approximately 2 to 8 seconds. ***A typical setting is 5 seconds.***

3.19 The DIALING/MASTER VOLUME controls can be adjusted as desired while test calls are in progress. These controls should initially be set at mid-range.

3.20 Start Dial Command

3.21 The start dial command determines the conditions which must be met before dialing can begin. As indicated in Fig. 26, the two programmable start dial conditions are DELAY and DIAL TONE.

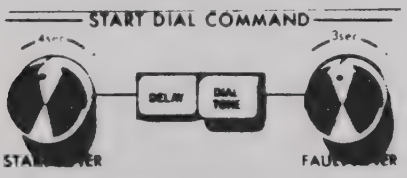


Fig. 26 — Start Dial Command Controls

Note: At least one of the DELAY or DIAL TONE buttons must be engaged to prevent a program error condition. Assuming previous operating instructions have been followed, a PROGRAM ERROR indication is not displayed when either DELAY or DIAL TONE is engaged.

3.22 Engaging only the DELAY button programs the Model 41-3A to begin dialing at the end of a set time interval following initial off-hook. This delay interval is set by the START AFTER control, which has a range of approximately 2 to 8 seconds. ***A typical setting is 4 seconds.***

3.23 Engaging only the DIAL TONE button programs the Model 41-3A to begin dialing upon receipt of a valid start-dial signal. The FAULT AFTER control setting determines the maximum wait time for the start-dial signal. If a start-dial signal is not detected during this fault-after interval, the test call is aborted, a no dial tone fault is recorded, and the NO DIAL TONE indicator lights. The fault-after interval can be set between approximately 1 to 7 seconds. ***A typical setting is 3 seconds.***

3.24 Either of the following is considered a valid start-dial signal:

(a) dial tone

(b) a reversed tip/ring polarity (off-hook) present on the line under test for at least 128 milliseconds, followed by a return to normal polarity (on-hook) for at least 128 milliseconds.

Note: The line under test can be in either the normal or reversed state prior to seizure.

3.25 The above engaged DELAY or DIAL TONE command must also be satisfied when a WSD (wait-for-start-dial) pause is encountered during dialing. (The WSD pause is discussed later under subject heading Dialer Program.)

3.26 When both DELAY and DIAL TONE commands are engaged, the Model 41-3A is programmed to:

(a) begin dialing when dial tone (or wink) is received, and

(b) to resume dialing after the START AFTER delay expires following a WSD pause.

3.27 Dialer Program

3.28 The dialer program defines the number to be dialed, the type of dialing, and certain dialing parameters. The DIALER PROGRAM controls are shown in Fig. 27.

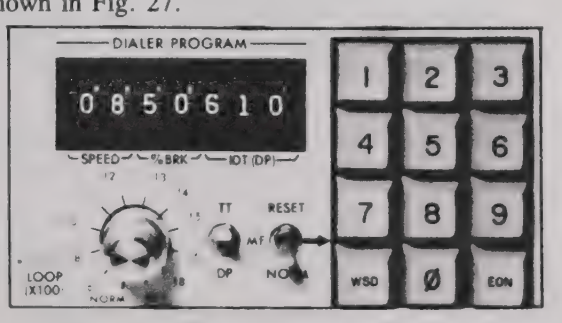


Fig. 27 — Dialer Program Controls

3.29 Place the TT/DP/MF switch in the appropriate position to select Touch-Tone® dial pulse, or multifrequency dialing. If MF is selected, the KP and ST tones are automatically transmitted at the proper times. The KP code is always transmitted for 100 milliseconds and is followed by a tone-off period of 70 milliseconds. The ST code and MF digits are transmitted as determined by SPEED and %BRK thumbwheel settings.

3.30 Place the RESET/-->/NORM switch to RESET, then to -> (load); the keypad can now be used to enter the dialing number. The number to be dialed should reach a type 102 or other suitable test line. When the Model 41-3A's built-in test line is used, the dialing number is the number of the incoming circuit.

> *Note:* The incoming circuit connections are explained under the subject heading "Telephone Line Connections." This subject is a part of the installation procedures.

3.31 Press the WSD key as needed to program wait-for-start-dial intervals between digits of the dialing number. When dialing through PBX-type equipment to reach a central office for example, enter a WSD between the digit (usually digit 9) used to obtain a second dial tone (or wink) and the remaining digits.

> *Note:* The WSD interval is determined by the START DIAL COMMAND controls, explained previously under the subject heading "Start Dial Command."

3.32 Press the EON key after keying all the dialing digits, and return the RESET/->/NORM switch to NORM. The dialing digits are displayed in the TEST PROGRESS readout at half brightness. (Dialed digits are displayed at full brightness.) The EON and WSD entries are not displayed.

> *Note:* A total of 32 digits plus one EON character can be stored in the Model 41-3A's dialer. Entered WSD characters are stored as digits. Each WSD character therefore reduces the numerical digit capacity by one. Also, only the first 11 numerical digits are displayed.

3.33 The Model 41-3A can be programmed to dial CAMA-ANI calling party digits by using the following steps:

(1) Set RESET/->/NORM switch to RESET, then to -> (load).

(2) Key the desired test line number (called party number), then press the EON key. (The called party number is displayed at this time.)

(3) Key the calling party number—it is not necessary to press the EON key after the calling party number. (Only the calling party number is displayed at this time.)

(4) Set RESET/->/NORM switch to NORM.

3.34 When programmed to dial CAMA-ANI calling party digits, the Model 41-3A dials the called party number first, then waits for a tip/ring polarity reversal lasting longer than 128 milliseconds before dialing the calling party number as multifrequency digits. (The KP and ST codes are automatically sent with calling party digits at the proper time.)

3.35 The DIALER PROGRAM thumbwheel switches are set as explained in the following steps.

(1) The two SPEED thumbwheels can be set between digit settings of 00 and 99. Typical settings are:

(a) 12 pulses per second for DP dialing

(b) 10 digits per second for TT or MF dialing.

(2) The two % BREAK thumbwheels can be set between digit settings of 00 and 99. Typical settings are:

(a) 60 percent break for DP dialing

(b) 50 percent tone-on duty cycle for TT and MF dialing.

(3) The three IDT (interdigital time) thumbwheels are used only for DP dialing. (The IDT settings have no effect for TT and MF dialing.) The IDT thumbwheels can be set between digit settings of 000 and 999. As shown in Fig. 28 below, the IDT setting and the make time add together to equal the interdigit time. The make time is determined by the SPEED and % BREAK settings, and it must be accounted for when specifying the interdigit time via the IDT thumbwheels. A proper IDT value is calculated as follows:

(a) Refer to the graph of Fig. 29, to find the intersection point of the set pulsing speed and percent break values.

(b) Select the diagonal line nearest the intersection.

(c) Read the make time (in milliseconds) at either end of the diagonal line.

(d) Subtract the make time from the desired interdigit time, and set the IDT thumbwheels to the calculated value.

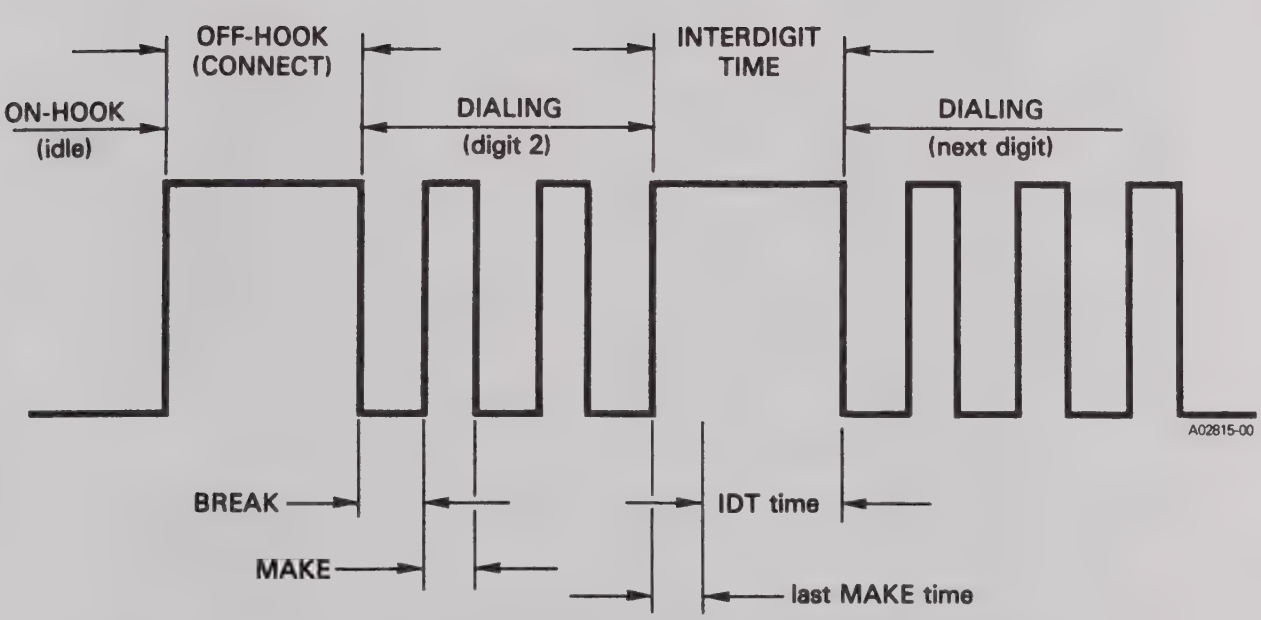


Fig. 28 — IDT Interval

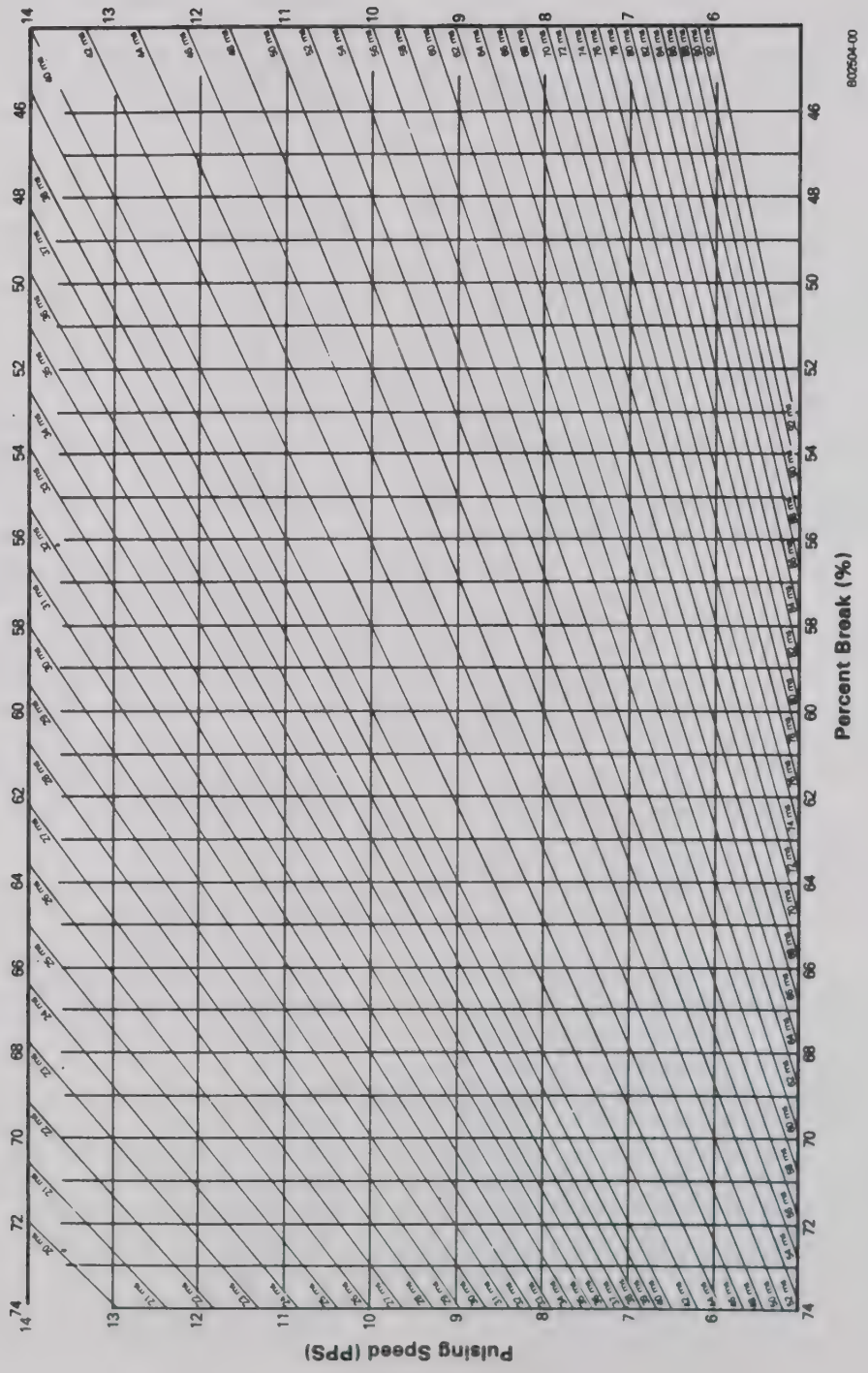


Fig. 29 — Make Time Graph

3.36 When DP dialing is used, one of several values of leak impedance or loop resistance can be selected with the LEAK/LOOP switches. It is not typical practice to use both leak impedance and loop resistance at the same time. When not used, these switches are set to the NORM position.

3.37 The LEAK (inner knob) selections are listed in Table G. The shunt networks are used internally to simulate the effects of ringing bridges, senders, etc. The last four resistive networks are primarily used when routining Stromberg-Carlson X-Y offices.

3.38 The LOOP (outer knob) selections are listed in Table H. The series networks are used to simulate the effects of various loop lengths.

TABLE G

LEAK IMPEDANCE NETWORKS

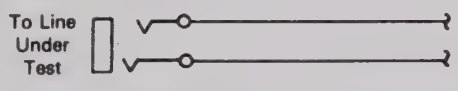
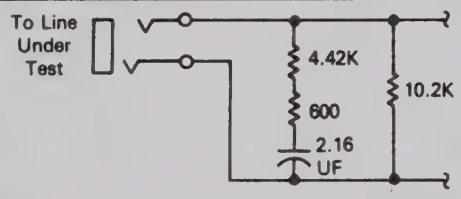
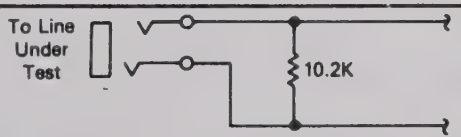
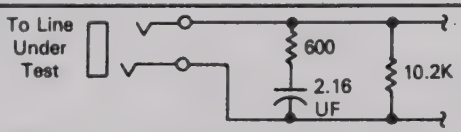
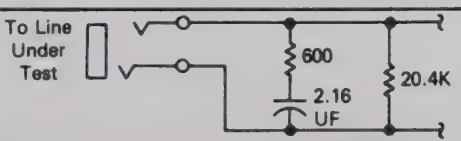
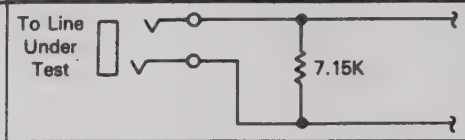
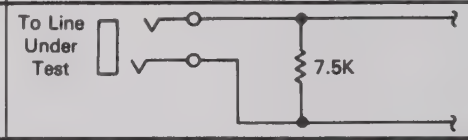
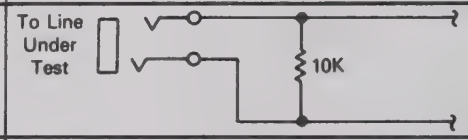
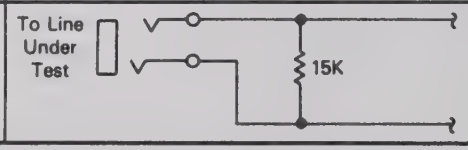
LEAK SWITCH SETTING	SCHEMATIC	SIMULATES
NORM		Open circuit.
A		A subscriber line near the central office equipped with five C4A ringing bridge extensions and a 15-kohm leak on the drop wire.
B		A sender output without contact protection and with a 10.2-kohm leak.
C		A circuit sender loop pulsing network with a 10.2-kohm leak across the trunk.
D		A sender output with a leak of 20.4-kohms.

TABLE G (Cont'd)

LEAK SWITCH SETTING	SCHEMATIC	SIMULATES	
7.15		A line with a 7.15-kohm leak.	For Stromberg-Carlson X-Y Offices
7.5		A line with a 7.5-kohm leak.	
10		A line with a 10-kohm leak.	
15		A line with a 15-kohm leak.	

802817-00

TABLE H

LOOP RESISTANCE VALUES

LOOP SWITCH POSITION	VALUE
N	< 1 ohm
6	600 ohms
8	800 ohms
10	1 kohms
11	1.1 kohms
12	1.2 kohms
13	1.3 kohms
14	1.4 kohms
15	1.5 kohms
16	1.6 kohms
18	1.8 kohms
19	1.9 kohms

C. Testing Instructions

3.39 After the Model 41-3A analyzer is correctly programmed as described in previous paragraphs, it can be applied to a routining task. Table I is provided as a suggested verification procedure prior to beginning an actual testing operation.

TABLE I

PROGRAM VERIFICATION

ACTION	RESULT
1. Place the MODE switch to SINGLE CALL.	The 41-3A goes off-hook on the selected channel (an idle channel A or B line). If the start dial program is satisfied, the unit dials the stored number. Dialed digits appear at full brightness in the TEST PROGRESS readout. The TEST PROGRESS display shows which operation is currently being performed. If the test program is satisfied, the TEST OK Indicator lights and a count is placed in the TEST OK category. If a programmed test is not satisfied, a fault is recorded in the test results category and an indicator lights. If busy or reorder tone is detected, an indicator lights and a count is recorded. The 41-3A also determines if a false tip/ring polarity reversal (answer) occurred with a busy or reorder tone. After all test results are determined, the 41-3A remains off-hook with a SYSTEM HELD indication. An alarm tone is heard from the unit's speaker.
2. If the Model 41-3A did not perform as expected, set the MODE switch to IDLE and recheck the programming and, if necessary, the installation instructions. Repeat step 1.	
3. Adjust DIALING/MASTER VOLUME controls as desired. (The DIALING VOLUME control sets the volume only when the unit is dialing.)	
4. Set the MODE switch to AUTO.	The 41-3A places a test call as described in step 1. After test results have been determined, the unit returns to on-hook unless held off-hook by a HOLD ON condition.

TABLE I (Cont'd)

ACTION	RESULT
4. Set the MODE switch to AUTO. (Cont'd)	*Note:* If troubleshooting on a held line is desired, refer to paragraph 3.41. All test result indications are removed when the unit returns to on-hook. The RECYCLE PERIOD control determines how long the unit remains on-hook before going off-hook to place another test call.
5. Place the MODE switch to IDLE and then to AUTO to release the unit from a SYSTEM HELD condition.	The 41-3A resumes testing.
6. If desired, engage the MANUAL pushbutton to manually hold the line under test.	The SYSTEM HELD indicator lights. The 41-3A remains off-hook at the end of the current test cycle.
7. Release the MANUAL pushbutton to resume automatic testing.	The 41-3A resumes testing.
8. Set the MODE switch to IDLE to release the line under test and halt all testing.	The IDLE indicator lights and testing stops.

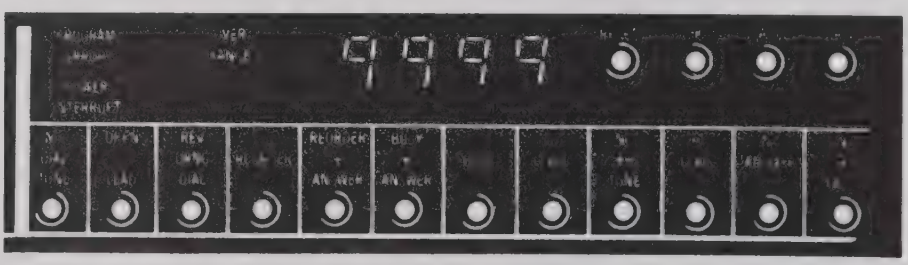


Fig. 30 — Test Results Readout

3.40 Test Results Readout

3.41 The TEST RESULTS readout normally displays the total number of tests performed. The counts stored for all other test result categories are displayed in the TEST RESULTS readout when the corresponding pushbuttons are pressed (see Fig. 30). To reset all test result categories to zero (blank display), press the RESET pushbutton while the MODE switch is at IDLE.

3.42 Included as part of the TEST RESULTS display are the OVER RANGE, POWER INTERRUPT, and PROGRAM ERROR indicators which are discussed separately as follows.

3.43 Over Range Indication

3.44 Each test result category has a count capacity of 9999. The TOTAL TESTS category reaches this count first. When this occurs, the OVER RANGE indicator lights. When a category reaches the over range count, the count begins again from zero. The OVER RANGE indication is removed by pressing the RESET button with the MODE switch at IDLE.

3.45 Power Interruption Indication

3.46 This indicator flashes to indicate a momentary loss of power. An off-to-on transition of the POWER switch causes this indicator to flash. When a power interruption occurs, the PROGRAM ERROR indicator lights and the unit is held on-hook. Pressing the RESET button for at least two seconds, with the MODE switch at IDLE, removes a power interrupt indication.

3.47 Program Error Indication

3.48 This message indicates that the 41-3A is incorrectly programmed. The unit is forced on-hook and cannot operate until all program errors are corrected. Possible program errors include:

(1) The MODE switch not at IDLE when RESET/->/NORM is set to RESET or -> (load)

(2) Both DELAY and DIAL TONE pushbuttons are released

(3) The ANS SUP, 1KHZ TONE, and INC CKT buttons are all released

(4) Both TEST A and TEST B buttons are released

(5) A power interruption occurs.

3.49 Troubleshooting a Call Completion Failure

3.50 If a call completion failure occurs for which a HOLD ON pushbutton is engaged, the 41-3A halts automatic operation and holds the failed line (off-hook) for troubleshooting. An alarm tone is heard at this time and the SYSTEM HELD message is displayed. If an open C-lead condition occurs on the failed line, the 41-3A automatically supplies up to approximately 180 mA of sleeve current to hold switched connections for troubleshooting.

3.51 When a failed line is held, all displayed digits appear at full brightness provided the entire number was successfully dialed. If a fault occurs during the dialing period, only successfully dialed digits are displayed at full brightness. Thus, a call completion failure detected during dialing can be pinpointed to a particular switching level by noting the relationship of half-bright to full-bright digits on the TEST PROGRESS readout.

3.52 A failed line is held as long as necessary for troubleshooting. A line is released and testing resumed by momentarily setting the MODE switch to IDLE, then to AUTO.

3.53 The unit's trace feature can be used to troubleshoot a call completion failure. If a failure on channel A, for example, is encountered and the line is held, an internal trace tone can be switched onto the line by engaging the TRACE A pushbutton. This action allows a resumption of testing on channel B while troubleshooting channel A. With TEST B engaged, resume testing on channel B by setting the MODE switch to IDLE and then to AUTO. (It is not necessary to release the TEST A button.) The TRACE B button can be used in the same manner to allow testing on channel A while troubleshooting channel B.

3.54 Use of External Test Equipment on a Held Line

3.55 The Model 41-3A automatically applies a 735-ohm termination to the selected call origination line when off-hook. This 735-ohm termination can affect testing (such as transmission level measurements) performed by external equipment. Use the following procedure to isolate the 735-ohm termination from the line under test while tests are made using external equipment.

(1) Use a patch cord with a type-310 plug to connect external equipment to the 41-3A's EXT jack.

(2) Select the necessary termination/impedance and dc holding with the external test equipment.

(3) Engage the TRACE pushbutton of the appropriate channel for the line under test. (This action applies a holding circuit to the line under test while the line is being switched to external equipment.)

D. Routining Examples

3.56 The following application examples illustrate the interconnections used between the Model 41-3A and telephone equipment for basic routining tasks. A particular dial mode (DP, TT, or MF) is assumed in each example. The actual dial mode in a routining task is determined by user requirements.

3.57 Routining an SXS Central Office

3.58 The Model 41-3A can routine an SXS central office with up to 1600 lines without changing the installation. Figure 31 shows a typical 41-3A setup. Test calls are routed to the 41-3A's incoming circuit so that regular office test lines are available for other purposes.

3.59 When an office has less than 16 line finder groups, the lines under test should be evenly divided between channel A and B. This division allows continued testing on a channel while the other channel is held for troubleshooting.

3.60 To routine an SXS central office, the 41-3A can be programmed as follows.

(1) Perform the front panel programming instructions of part A.

(2) Set the DB controls for an EML (expected measured level) of 0 dBm with high and low limits of 5 dB.

(3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60, and an IDT (interdigital time) of 600 milliseconds.

(4) Set POWER on.

(5) Press the RESET pushbutton for at least 2 seconds.

(6) Engage the following pushbuttons.

(a) TEST A

(b) TEST B

(c) DIAL TONE

(d) OPEN C-LEAD

(e) 1KHZ TONE

(f) INC CKT

(g) FAULT.

(7) Set the RESET/->/NORM switch to RESET, then to load (->).

(8) Use the keyset to enter the number needed to reach the 41-3A's internal test line, then press the EON key.

(9) Set the RESET/->/NORM switch to NORM.

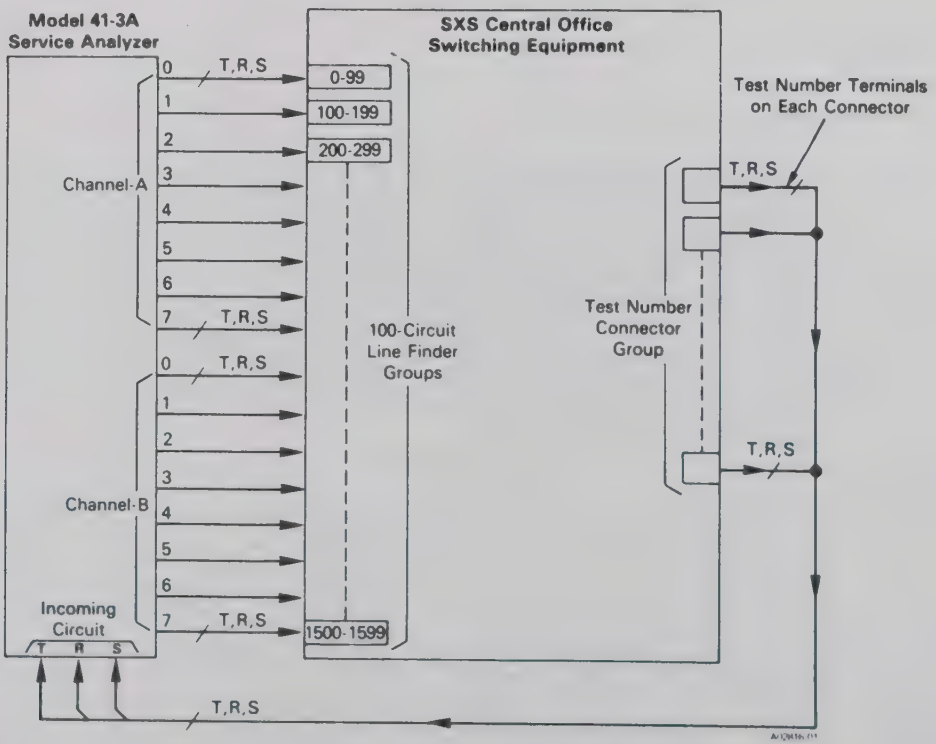


Fig. 31 — Routining a 1600-Line SXS Office

3.61 The above programming prepares the 41-3A analyzer for the following functions.

(1) Alternate test calls between channels A and B.

(2) Begin dialing after dial tone is detected.

(3) After dialing begins, check the sleeve lead of the line under test for an open circuit or battery potential.

(4) Determine if the 41-3A's internal test line is reached. When reached, this test line is used to send a 1-kHz tone back through the office switching equipment to the 41-3A's line on which the call was made.

(5) Check for the presence of the 1-kHz tone on the line under test at a level of 0 dBm +/− 5 dB. The selected expected level is 0 dBm for both 600 and 900 ohm circuits.

(6) Halt all testing and maintain an off-hook condition on the line under test if any of the following faults occur.

(a) Dial tone is not detected within approximately 3 seconds (FAULT AFTER delay) after the 41-3A goes off-hook.

(b) The sleeve of the line under test has an open circuit or is more negative than −11V after dialing begins. (The 41-3A automatically supplies up to 180 mA of sleeve current to hold switched connections for troubleshooting.)

(c) The internal test line is not reached within approximately 15 seconds (NETWORK delay) after dialing is completed. Refer to paragraph 2.25 for call completion requirements.

(d) A 1-kHz tone at a level of 0 dBm +/− 5 dB is not present on the line under test within approximately 15 seconds after dialing is completed.

3.62 To first verify installation and programming, place a single test call by setting the MODE switch to SINGLE CALL. Adjust the DIALING/MASTER VOLUME control as desired. If the 41-3A does not perform as expected, return the MODE switch to IDLE and check installation and programming. Place the MODE switch to AUTO for automatic testing.

3.63 If the 41-3A detects a fault, an alarm is heard and an indicator lamp shows the type of fault. The Model 41-3A remains off-hook on the line under test and all testing stops. When this happens, pressing the appropriate TRACE pushbutton applies a trace tone on the line under test for troubleshooting. While troubleshooting on one channel, testing is resumed on the other channel by momentarily placing the MODE switch to IDLE, then to AUTO.

3.64 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test results are displayed in the TEST RESULTS readout when appropriate pushbuttons are pressed. All test result indicators are defined in part D.

3.65 Set the MODE switch to IDLE to release a line under test and halt all testing.

3.66 Routining Outgoing Trunks

3.67 This application describes routining outgoing loop trunks which require dc pulse dialing. (An application involving multifrequency dialing is given later for routining incoming trunks.) The 41-3A can be connected to outgoing trunks as shown in Fig. 32.

Note: When used with a Model 3541 Adaptor, the Model 41-3A can also be used in 4-wire and E&M circuit applications.

3.68 When an office has less then 16 line finder groups, the lines under test should be evenly divided between channel A and B. This division allows continued testing on a channel while the other channel is held for troubleshooting.

3.69 To routine outgoing trunks, the 41-3A can be programmed as follows.

(1) Perform the front panel programming instructions of part A.

(2) Set the DB controls for an EML (expected measured level) of 0 dBm minus the estimated loss in the outgoing trunks, with low and high limits of 5 dB.

(3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60, and an IDT (interdigital time) of 600 milliseconds.

(4) Set POWER on.

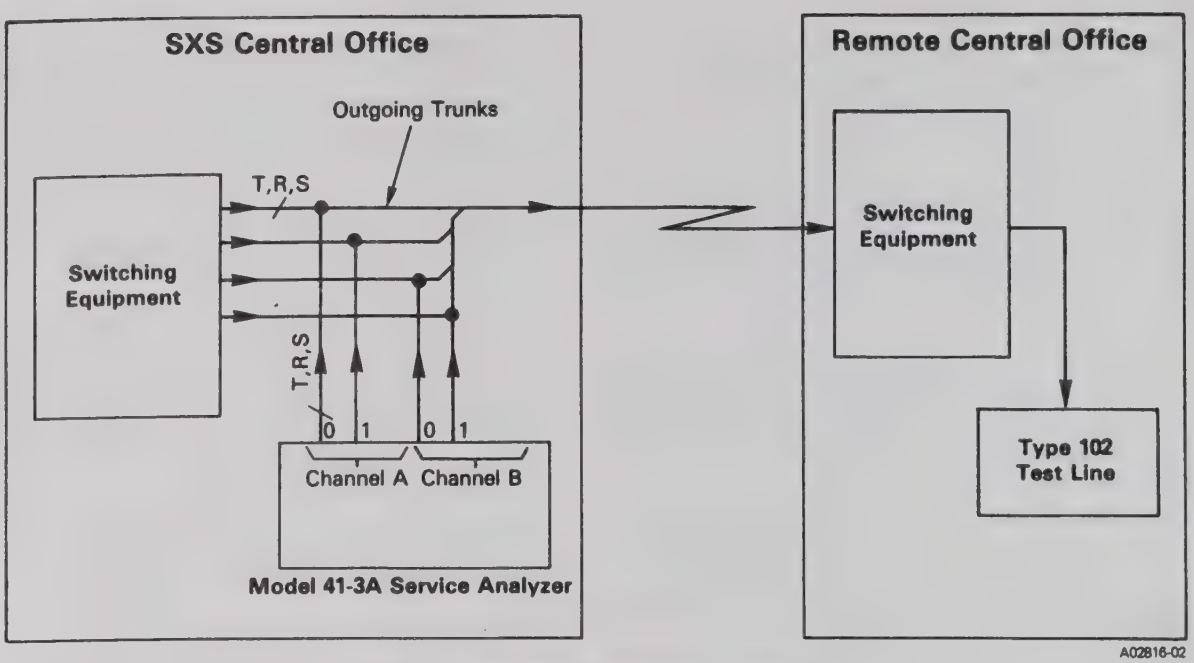


Fig. 32 — Routining Outgoing Trunks

(5) Press the RESET pushbutton for at least 2 seconds.

(6) Engage the following pushbuttons.

(a) TEST A

(b) TEST B

(c) DELAY

(d) ANS SUP

(e) 1KHZ TONE

(7) Set the RESET/->/NORM switch to RESET, then to load (->).

(8) Use the keyset to enter the number needed to reach a source of 1-kHz tone (such as a type 102 test line) located at the far end of the outgoing trunks. After this number has been entered, press the EON key.

(9) Set the RESET/->/NORM switch to NORM.

3.70 The above programming prepares the 41-3A analyzer for the following functions.

(1) Alternately check channels A and B for trunks that are idle (sleeve lead opened or more negative than -11V). The Model 41-3A goes off-hook when an idle trunk is selected.

(2) Begin dialing approximately 4 seconds (START AFTER delay) after the 41-3A goes off-hook.

(3) Check for the presence of the 1-kHz tone on the line under test at a level within the range of the DB control settings. The expected level is as set by the EML control for both 600 and 900 ohm circuits.

(4) Check for the presence of answer supervision (tip/ring polarity reversal) after dialing is completed.

(5) Continue testing after a fault is detected.

3.71 The 41-3A is programmed to detect a fault if either of the following events occur.

(1) A 1-kHz tone is not present on the trunk under test within approximately 15 seconds (NETWORK delay) after dialing is completed. Also, the 1-kHz tone must be detected at a level within the range set by the DB controls to avoid a fault indication.

(2) Answer supervision is not detected within approximately 15 seconds after dialing is completed.

3.72 To first verify installation and programming, place a single test call by setting the MODE switch to SINGLE CALL. Adjust the DIALING/MASTER VOLUME control as desired. If the 41-3A does not perform as expected, return the MODE switch to IDLE and check installation and programming. Place the MODE switch to AUTO for automatic testing.

3.73 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test results are displayed in the TEST RESULTS readout when appropriate pushbuttons are pressed. All test result indicators are defined in part D.

3.74 Set the MODE switch to IDLE to release a line under test and halt all testing.

3.75 Routining Incoming Trunks

3.76 This application describes routining incoming trunks which require multifrequency dialing. Figure 33 shows a typical setup for routining incoming trunks. When less than 16 trunks are tested, they should be evenly divided between channel A and B to allow continued testing on one channel while the other channel is held for troubleshooting.

3.77 To routine incoming trunks, the 41-3A can be programmed as follows.

(1) Perform the front panel programming instructions of part B above.

(2) Set the DB controls for an EML (expected measured level) of 0 dBm with low and high limits of 5 dB.

(3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 10 digits per second and a percent tone of 50. The IDT thumbwheels are not used in this application.

(4) Set the TT/DP/MF switch to MF.

(5) Set POWER on.

(6) Press the RESET pushbutton for at least 2 seconds.

(7) Engage the following pushbuttons.

(a) TEST A

(b) TEST B

(c) DIAL TONE
(programs wink detection)

(d) ANS SUP

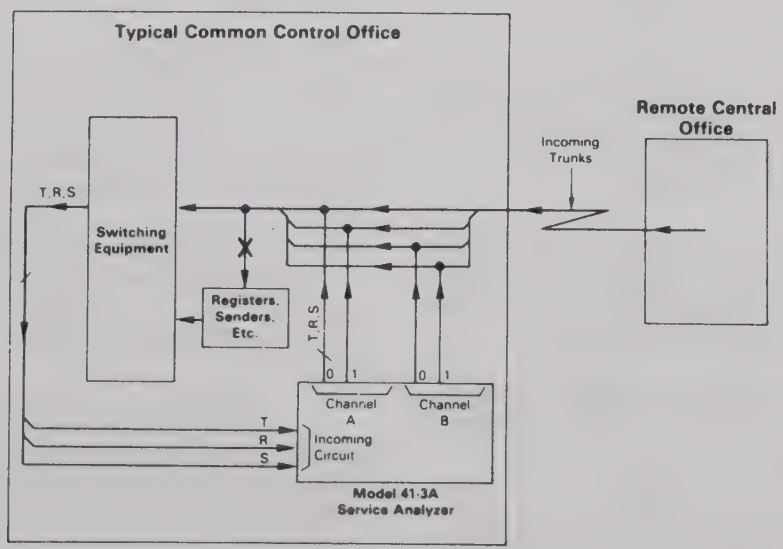


Fig. 33 — Routining Incoming Trunks

(e) 1KHZ TONE

(f) INC CKT

(g) FAULT

(8) Set the RESET/->/NORM switch to RESET, then to load (->).

(9) Use the keyset to enter the number needed to reach the 41-3A's incoming test line, then press the EON key.

(10) Set the RESET/->/NORM switch to NORM.

3.78 The above programming prepares the 41-3A analyzer for the following functions.

(1) Alternately check channels A and B for trunks that are idle (sleeve lead opened or more negative than -11V). The Model 41-3A goes off-hook when an idle trunk is selected.

(2) Begin dialing after a wink or similar start-dial signal (off-hook to on-hook tip/ring polarity reversal) is detected.

(3) Transmit the KP and ST signals at the proper times.

(4) Check for the presence of answer supervision (tip/ring polarity reversal) after dialing is completed.

(5) Determine if the 41-3A's internal test line is reached. When reached, this test line is used to send a 1-kHz tone back through the office switching equipment to the 41-3A's line on which the call was made.

(6) Check for the presence of the 1-kHz tone on the line under test at a level of 0 dBm +/- 5 dB. The selected expected level is 0 dBm for both 600 and 900 ohm circuits.

(7) Halt all testing and maintain an off-hook condition on the line under test if any of the following faults occur.

(a) A wink or similar start-dial signal is not detected within approximately 3 seconds (FAULT AFTER delay) after the 41-3A goes off-hook.

(b) Answer supervision is not detected within approximately 15 seconds (NETWORK delay) after dialing is completed.

(c) The internal test line is not reached within approximately 15 seconds after dialing is completed. Refer to paragraph 2.25 for call completion requirements.

(d) A 1-kHz tone at a level of 0 dBm +/- 5 dB is not present on the line under test within approximately 15 seconds after dialing is completed.

3.79 To first verify installation and programming, place a single test call by setting the MODE switch to SINGLE CALL. Adjust the DIALING/MASTER VOLUME control as desired. If the 41-3A does not perform as expected, return the MODE switch to IDLE and check installation and programming. Place the MODE switch to AUTO for automatic testing.

3.80 If the 41-3A detects a fault, an alarm is heard and an indicator lamp shows the type of fault. The Model 41-3A remains off-hook on the line under test and all testing stops. When this happens, pressing the appropriate TRACE pushbutton applies a trace tone on the line under test for troubleshooting. While troubleshooting on one channel, testing is resumed on the other channel by momentarily placing the MODE switch to IDLE, then to AUTO.

3.81 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test results are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed. All test result indicators are defined in part D.

3.82 Set the MODE switch to IDLE to release a line under test and halt all testing.

3.83 Routining PBX Trunks

3.84 The Model 41-3A can routine PBX trunks via switching equipment in a private branch exchange. Assuming an SXS or similar type PBX. Figure 34 shows a typical Model 41-3A setup. When less than 16 line finder groups are available, the lines under test should be evenly divided between channel A and B to allow continued testing on one channel while the other channel is held for troubleshooting.

3.85 To routine PBX trunks, the 41-3A can be programmed as follows.

(1) Perform the front panel programming instructions of part B.

(2) Set the DB controls for an EML (expected measured level) of 0 dBm minus the estimated loss in the PBX trunks under test. Set high and low limits of 5 dB.

(3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 50, and an IDT (interdigital time) of 600 milliseconds.

(4) Set POWER on.

(5) Press the RESET pushbutton for at least 2 seconds.

(6) Engage the following pushbuttons.

(a) TEST A

(b) TEST B

(c) DIAL TONE

(d) REV DRNG-DIAL

(e) 1KHZ TONE

(7) Set the RESET/->/NORM switch to RESET, then to load (->).

(8) Use the keyset to enter the digit required by the PBX switching equipment to obtain the second dial tone (usually the digit 9). Press the WSD key, then enter the number needed to reach a source of 1-kHz tone (such as a type 102 test line) located in the serving central office. After the number to be dialed has been entered, press the EON key.

(9) Set the RESET/->/NORM switch to NORM.

3.86 The programming described in the preceding paragraph prepares the 41-3A analyzer for the following functions.

(1) Alternate between channels A and B.

(2) Dial the first digit after dial tone is detected, then wait for an additional dial tone before resuming the dialing.

(3) Check for a false tip/ring polarity reversal during dialing. This condition discloses reversed wipers in SXS switch trains.

(4) Check for the presence of the 1-kHz tone on the PBX trunk under test at a level within the range of the DB control settings. The expected level is as set by the EML control for both 600 and 900 ohm circuits.

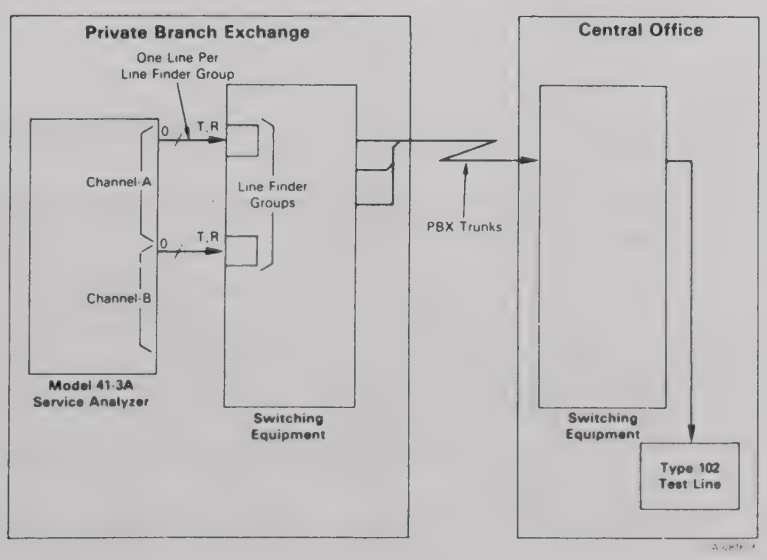


Fig. 34 — Routining PBX Trunks

(5) Continue testing after detection of a fault. A fault is recorded if any of the following conditions occur.

(a) Dial tone is not detected within approximately 3 seconds (FAULT AFTER delay) after the 41-3A goes off-hook or within approximately 3 seconds after the first digit is dialed.

(b) A false tip/ring polarity reversal detected during dialing.

(c) A 1-kHz tone is not present on the PBX trunk under test within approximately 15 seconds (NETWORK delay) after dialing is completed. Also, the 1-kHz tone must be detected at a level within the range set by the DB controls to avoid a fault indication.

3.87 To first verify installation and programming, place a single test call by setting the MODE switch to SINGLE CALL. Adjust the DIALING/MASTER VOLUME control as desired. If the 41-3A does not perform as expected, return the MODE switch to IDLE and check installation and programming. Place the MODE switch to AUTO for automatic testing.

3.88 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test results are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed. All test result indicators are defined in Table F.

3.89 Set the MODE switch to IDLE to release a line under test and halt all testing.

4. OPERATION VIA REMOTE CONTROL OPTION

4.01 The ERC Option enables the Model 41-3A to be operated under control of a remote/local keyboard terminal or host computer (micro, mini, etc.)

4.02 After the Model 41-3A is powered up (or its ac power is returned following an interruption), it transmits a SYSTEM RESET message. As shown in Fig. 35, the Model 41-3A must then be placed in its system ready mode to allow use of its other functional modes. (The system ready mode also permits the Model 41-3A to be operated directly from its own front panel controls.)

Note: Spurious noise at power-up may prevent a system reset condition. If so, check that the tape drive (if used) is turned on, repower the terminal, and then the Model 41-3A.

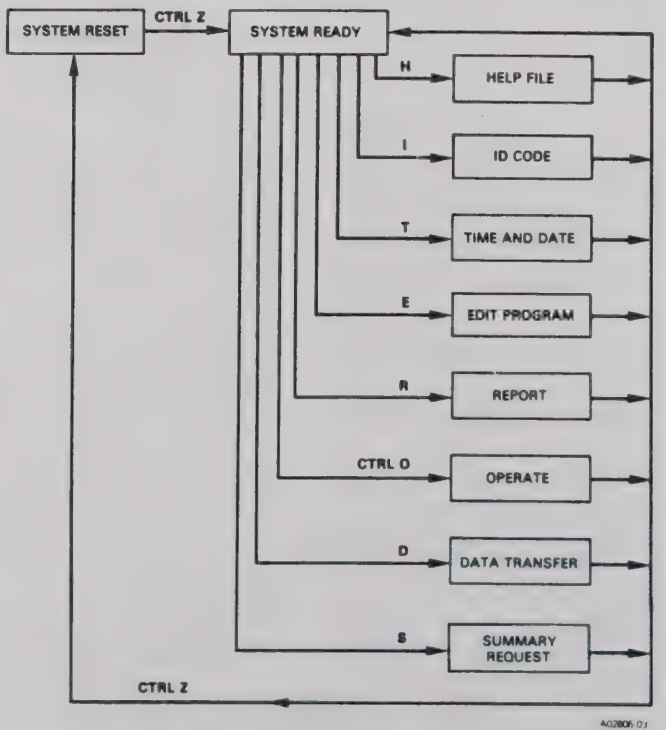


Fig. 35 — ERC Control Modes

4.03 A keyboard programming exercise is presented first to quickly familiarize an operator with Model 41-3A's internal control structure. Following this programming exercise, each control mode shown in Fig. 35 is discussed in detail under an appropriate subject heading (System Reset, System Ready, etc.). Protocol requirements for control of the Model 41-3A via a host computer device are discussed last.

A. Programming Exercise

4.04 After the POWER switch of the Model 41-3A with ERC is turned on and its POWER INTERRUPT indicator begins flashing, an initial system reset message is sent to the terminal. Step 1 of the programming exercise begins after the initial reset indication shown in Fig. 36.

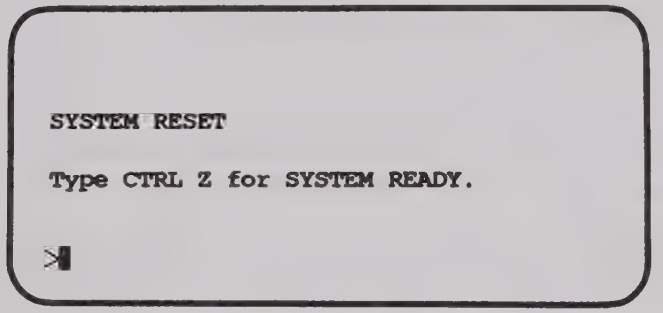


Fig. 36 — System Reset

Note: The assigned functions of the CTRL and other special keys are tabulated in Table J for quick reference.

TABLE J

SPECIAL KEYBOARD FUNCTIONS

KEY	FUNCTION
CAPS LOCK (UPPERCASE)	Must be locked down at all times for proper uppercase alphabetic commands.
CTRL	Used in conjunction with designated letter keys, e.g., CTRL Z, CTRL E, CTRL O, etc. (CTRL key is held depressed and then the letter key is pressed)
SHIFT	Used when assigning a positive (+) sign to parameter values
RETURN	Referred to as a <RET> entry (used for several command functions)
SPACE BAR	Referred to as <SB> entry when necessary to distinguish it from other designated keys (it serves the same function as a standard typewriter space bar).
DELETE (or RUB OUT)	Referred to as a <DELETE> entry (used as an editing function)

Step 1. As instructed in Fig. 36, a CTRL Z command is required to place the 41-3A system in a ready status. ***Hold down the CONTROL key, then press the Z key. Compare your terminal display to Fig. 37.***

```
SYSTEM BUSY - INITIALIZING TAPE DRIVE

SIT Option installed and operating.

SYSTEM READY

Type H to display COMMAND MENU.

>
```

Fig. 37 — System Ready

Note: A system-busy message may precede a ready notification. The SIT message informs the operator that the 41-3A is equipped with the SIT feature and that the SIT detector is operational.

Step 2. As instructed in Fig. 37, an H (help) command is used to obtain a list of commands (Fig. 38) needed to operate the Model 41-3A. ***Press the H key.***

```
  41-3A REMOTE SERVICE ANALYZER COMMAND MENU
                VERSION 1.0

COMMAND |       DESCRIPTION
--------|-----------------------------------------------
 CTRL Z | RESETS the 41-3A at any time.
   H    | Display the COMMAND MENU.
   I    | Set the unit IDENTIFICATION CODE.
   T    | Set the system TIME and DATE.
   E    | Enter the EDIT PROGRAM mode.
   R    | Set the REPORT mode.
 CTRL O | Enter the OPERATE mode.
   D    | Enter the DATA TRANSFER mode.
   S    | Immediately provide a SUMMARY report output
-------------------------------------------------------

  >
```

Fig. 38 — Model 41-3A Command Menu

Step 3. Steps 3 and 4 use the ID mode to program an identification code for this programming exercise. ***Press the I key.***

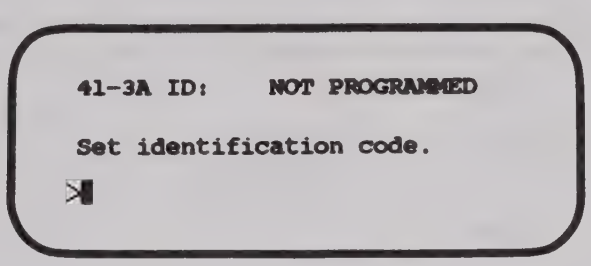


Fig. 39 — ID Code Mode

Step 4. The NOT PROGRAMMED indication in Fig. 39 appears when an ID code has not been assigned; otherwise the code previously programmed is shown. In either case, ***type EXERCISE 1, then press the RETURN key.***

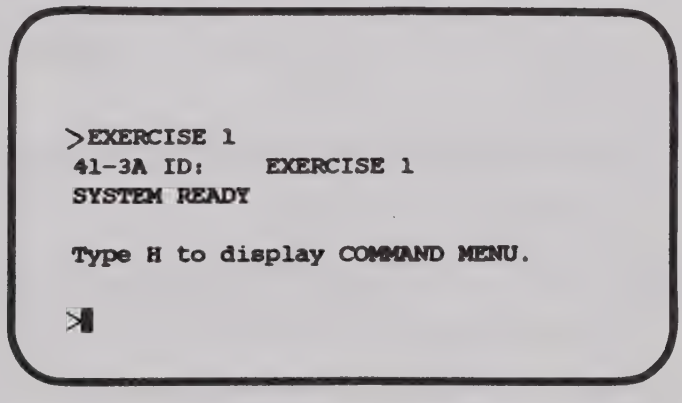


Fig. 40 — ID Code Verification

Note: The RETURN key entry is designated as a < RET > command.

Step 5. Steps 5 and 6 use the time and date mode to initialize a 24-hour clock in the Model 41-3A. ***Press key T.***

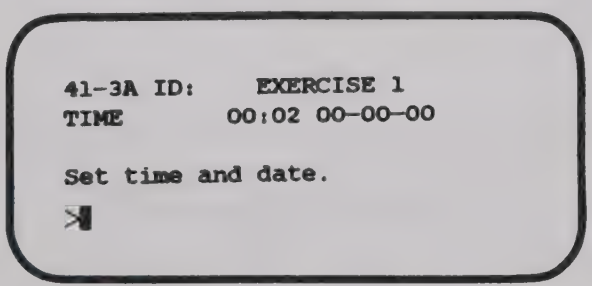


Fig. 41 — Set Time and Date Mode

Note: Assuming 2 minutes have elapsed since power-up of the Model 41-3A, a time indication of 00.02 is given in Fig. 41.

Step 6. The entry format is hour, minute, month, day, and year. The digit sequence 0918072884, for example, initializes time at 9:18 AM and the date at July 28, 1984. ***Type 0918072884.***

```
>09:18 07-26-84

41-3A ID:     EXERCISE 1
TIME        09:18 07-28-84

SYSTEM READY

Type H to display COMMAND MODE.

>
```

Fig. 42 — Time and Date Verification

Step 7. Steps 7 thru 16 use the edit mode to assemble and store a call program in the Model 41-3A. ***Press key E.***

```
EDIT MODE

Type H to display EDIT COMMANDS.

>S1D2F1H0000T2000L-25+10C40A1$
>
```

Fig. 43 — Edit Mode

Step 8. The example display used for Fig. 43 shows a previously stored instruction (S1D2F1H0000T2000L-25+10C40A1$). This instruction (and other instructions which may have been stored after it) can be removed. ***Enter a CTRL C command.***

```
SYSTEM BUSY - CLEARING REMAINING TEST CALL PROGRAM
>
```

Fig. 44 — Edit Mode Clearing Message

Step 9. The CTRL C command is only one of several edit mode commands. A list of other editing commands is available. ***Press the H key.***

```
EDIT COMMAND MENU

COMMAND    |   DESCRIPTION
-----------|-------------------------------------------------------------
   S       | Enter the SWITCH/CONTROL mode.
   F       | Display SWITCH/CONTROL format.
 S<RET>    | Clear the current entry.
           |
   N       | Enter the EDIT ADDRESS mode.
   A       | Display ADDRESS format.
 DELETE    | Delete the last address digit.
 N<RET>    | Clear current entry.
           |
 CTRL U    | Abort edit of current entry.
 CTRL C    | Clear the remaining test call program.
CTRL F### | Move forward ### lines  (# = 0 to 9, CTRLF, CTRLU or <RET>).
CTRL B### | Move backward ### lines (# = 0 to 9, CTRLB, CTRLU or <RET>).
           |
 CTRL E    | Exit EDIT mode.
-------------------------------------------------------------------------

>
```

Fig. 45 — Edit Command Menu

Step 10. The first example instruction to be assembled and stored is a switch control instruction. To display the switch control format, ***press key F.***

```
>  FORMAT       FUNCTION              SELECTION
I-------------------------------------------------------------------------I
I S#           START DIAL   1 = DELAY   2 = DIAL TONE       3 = BOTH      I
I-------------------------------------------------------------------------I
I D#            DIAL TYPE   1 = DP      2 = TT    4 = MF                  I
I-------------------------------------------------------------------------I
I F#            FAULT ON    0 = NONE    1 = C     2 = REV     3 = BOTH    I
I-------------------------------------------------------------------------I
I H####           HOLD ON   0 = NO      1 = REORDER         2 = BUSY      I
I                           4 = REORDER or BUSY and ANSWER  8 = FAULT     I
I-------------------------------------------------------------------------I
I T####         TEST OK ON  1 = ANSWER                  2 = 1-KHZ LEVEL   I
I                           4 = INC CIRCUIT             8 = C-MESSAGE NOISE I
I-------------------------------------------------------------------------I
I L######   1-KHZ WINDOW            RANGE = -30 to +10 dBm   *              I
I-------------------------------------------------------------------------I
I C##     C-MESSAGE LEVEL           RANGE = 15 to 55 dBrnC                  I
I-------------------------------------------------------------------------I
I AB          LINE SELECT       ALL LINES =   <RET> or AB<RET>            I
I                             ONE CHANNEL =  A<RET> or  B<RET>            I
I                             SINGLE LINE = A#<RET> or B#<RET>            I
I-------------------------------------------------------------------------I

>
```

Fig. 46 — Switch Control Format

Step. 11. The instruction to be programmed (Fig. 47) contains dial tone, DP, no fault, no hold, and 1-kHz tone selections. ***First, press key S. Then type digit sequence 210 for the S#, D#, and F# functions. Type 0000 for the H#### and 2000 for the T#### functions. Type −30 and +10 (use SHIFT key for + sign) to select the full dBm level range. Finally, enter a <RET> to select all lines and store the instruction.***

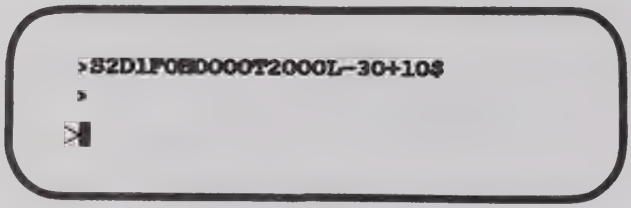


Fig. 47 — Switch Control Instruction

Step 12. The next instruction to be assembled and stored is an address instruction. To obtain the entry format, ***type A.***

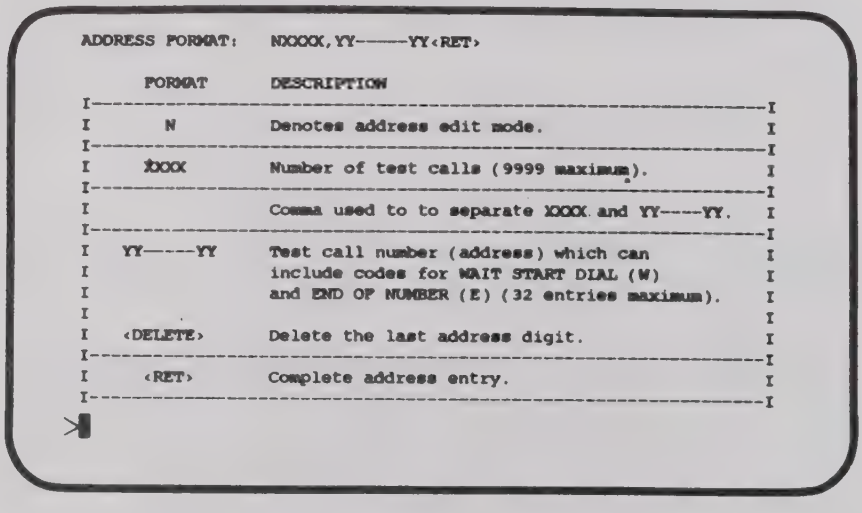

ADDRESS FORMAT: NXXXX,YY------YY<RET>
FORMAT DESCRIPTION
N Denotes address edit mode.
XXXX Number of test calls (9999 maximum).
Comma used to to separate XXXX and YY-----YY.
YY-----YY Test call number (address) which can include codes for WAIT START DIAL (W) and END OF NUMBER (E) (32 entries maximum).
<DELETE> Delete the last address digit.
<RET> Complete address entry.

Fig. 48 — Address Format

Step 13. The address instruction (Fig. 49) to be assembled and stored programs the Model 41-3A to dial 4 test calls to telephone number 224-6511. ***Type N4 to designate the address mode and the number of test calls. Separate this entry with a comma (,) and then type 2246511. Enter a < RET > to store this instruction.***

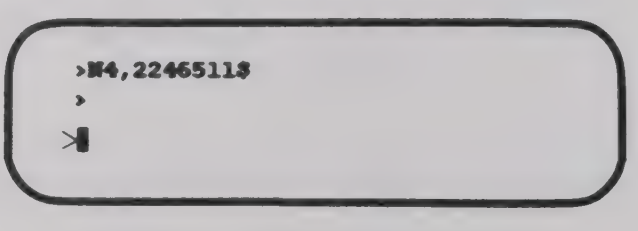


Fig. 49 — Address Instruction

Step 14. The two instructions programmed in steps 11 and 13 make up the call program currently stored in the Model 41-3A. (Additional instructions could be added to this program.) To review the current call program as shown in Fig. 50, ***key three successive CTRL B commands.***

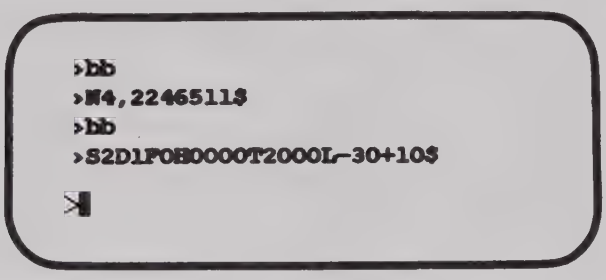


Fig. 50 — Move Backward Mode

Step 15. Figure 50 reveals the stored instructions in reverse order. To view the program in a forward order, ***key a RETURN to exit the backward mode, then key two CTRL F commands.***

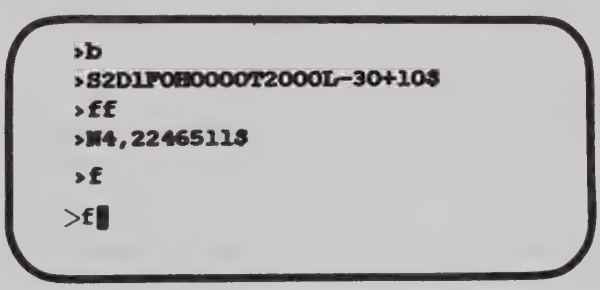


Fig. 51 — Move Forward Mode

Step 16. This step returns the Model 41-3A to its system ready mode (Fig. 37). ***First, use a < RET > to exit the forward mode of step 15. Then key a CTRL E to exit the edit mode and receive a system ready message.***

Step 17. Steps 17 thru 21 use the report mode to clear any report data previously stored in the Model 41-3A. ***Press key R.***

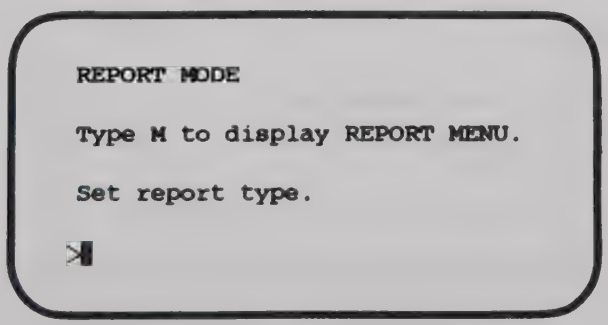


Fig. 52 — Report Mode

Step 18. *Type M to obtain the report menu of Fig. 53.*

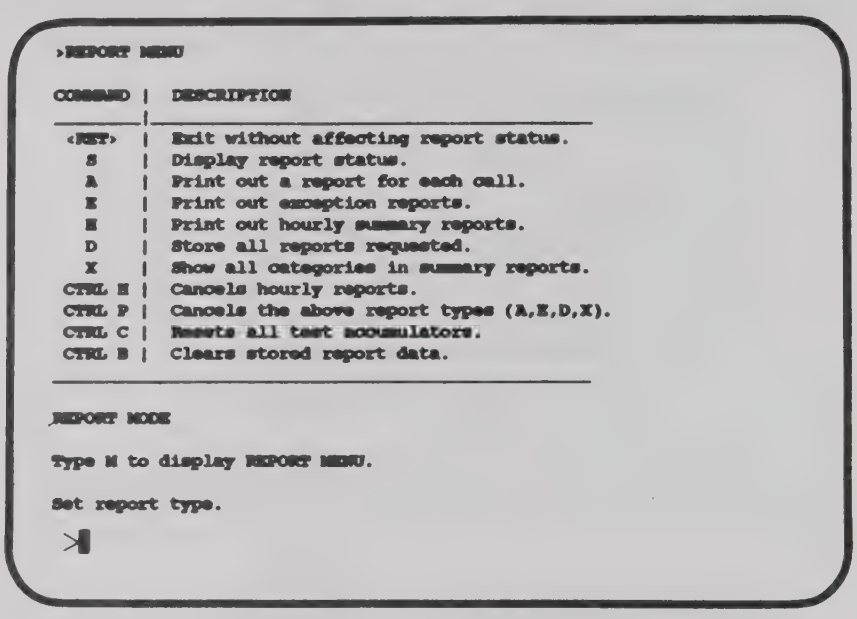

>REPORT MENU
COMMAND | DESCRIPTION
<RET> | Exit without affecting report status.
S | Display report status.
A | Print out a report for each call.
E | Print out exception reports.
H | Print out hourly summary reports.
D | Store all reports requested.
X | Show all categories in summary reports.
CTRL H | Cancels hourly reports.
CTRL P | Cancels the above report types (A,E,D,X).
CTRL C | Resets all test accumulators.
CTRL B | Clears stored report data.
REPORT MODE
Type M to display REPORT MENU.
Set report type.
>

Fig. 53 — Report Mode Menu

Step 19. Use a CTRL B to clear (remove) any stored report data and a CTRL P to cancel any requested reports. Then key in the S command to view the report status of Fig. 54.

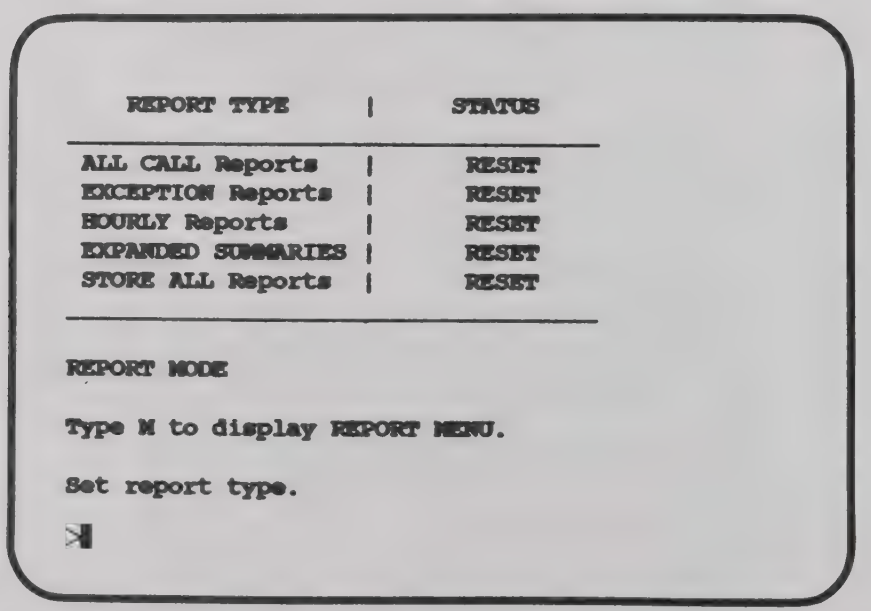


Fig. 54 — Report Status

Step 20. The status example of Fig. 31 shows that no report types have been requested. ***Enter a < RET > to exit the report mode and return to the system ready condition (Fig. 37).***

Step 21. Steps 21 thru 23 use the operate mode to perform a dialing operation. ***Enter a CTRL O (use letter O, not digit zero).***

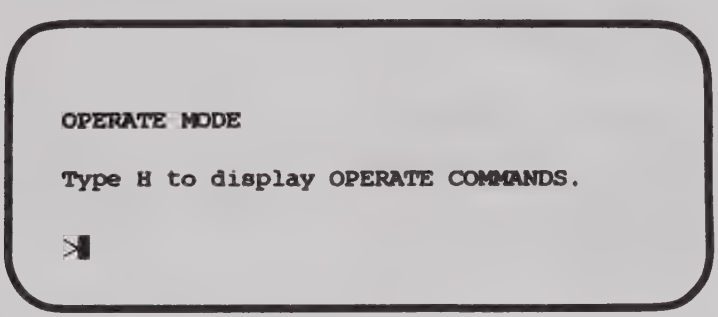


Fig. 55 — Operate Mode

Step 22. *Type H.*

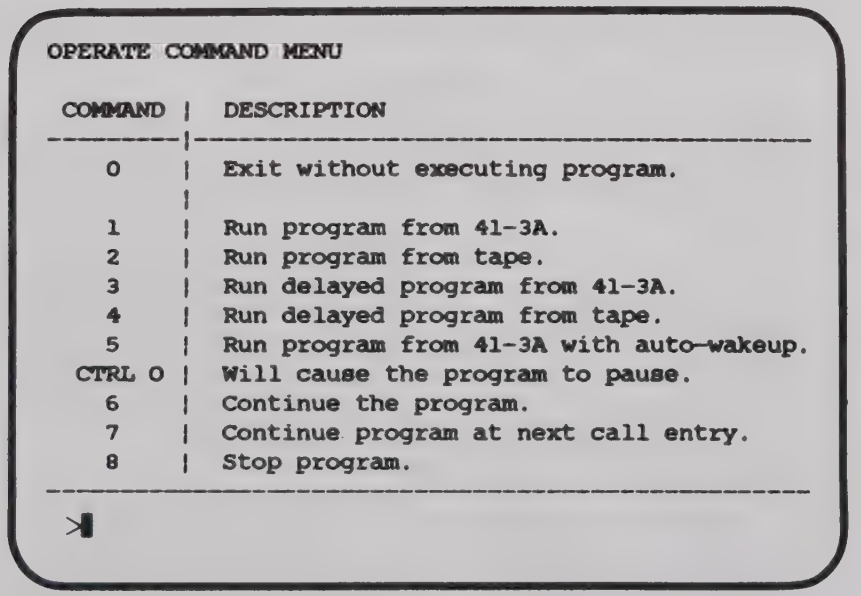

OPERATE COMMAND MENU
COMMAND | DESCRIPTION
0 | Exit without executing program.
1 | Run program from 41-3A.
2 | Run program from tape.
3 | Run delayed program from 41-3A.
4 | Run delayed program from tape.
5 | Run program from 41-3A with auto-wakeup.
CTRL O | Will cause the program to pause.
6 | Continue the program.
7 | Continue program at next call entry.
8 | Stop program.
>

Fig. 56 — Operate Command Menu

Step 23. Command 1 of the operate menu will now be used to run the program currently stored in the Model 41-3A (see step 15). At the end of this dialing operation, the 41-3A automatically transmits a call summary report as shown in Fig. 57. This is the only report transmitted as per the request of step 19. ***Type digit 1.***

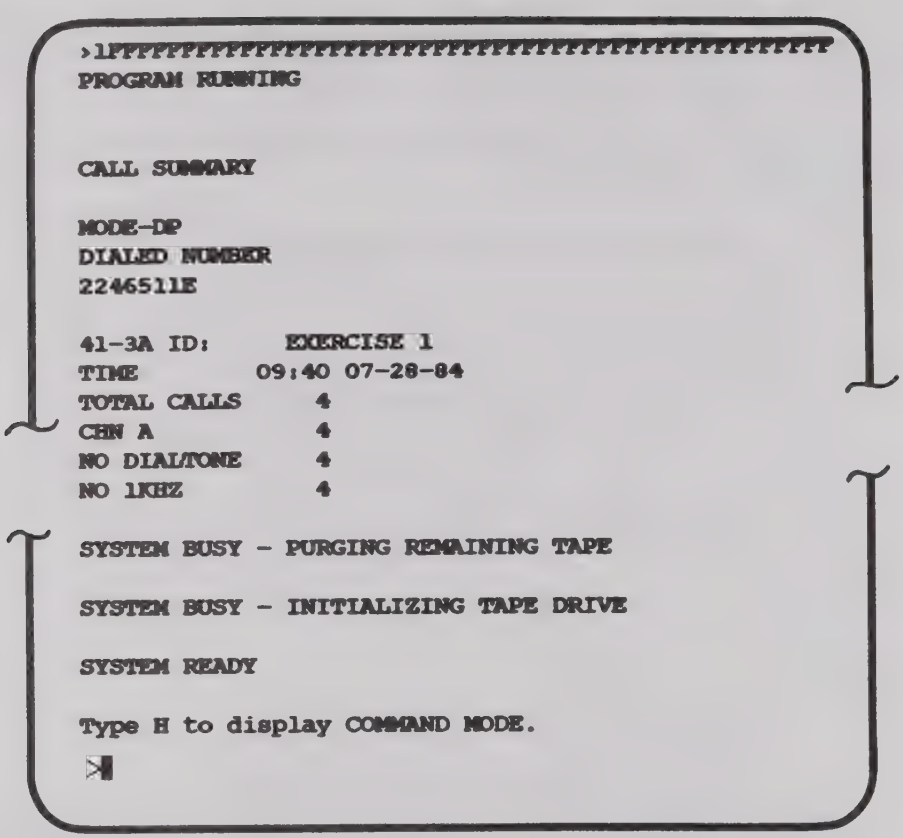


Fig. 57 — Program Run Example

Step 24. This completes the programming exercise. Although the data transfer and summary report request modes were not included in this exercise, these and all other control modes of Fig. 35 are discussed under appropriate headings which follow.

B. System Reset

4.05 In the system reset condition the internal processor of the Model 41-3A is initialized. Previously stored programming and data are preserved.

4.06 The Model 41-3A transmits an initial system reset message (see Fig. 36) after its power switch is turned on and its POWER INTERRUPT indicator begins flashing. An entry other than CTRL Z at this time causes a retransmission of the reset message. Use of the CTRL Z command at this time turns off the POWER INTERRUPT indicator and places the Model 41-3A in a system ready status.

> *Note:* The Model 41-3A's front panel RESET pushbutton can also be used to turn off a flashing POWER INTERRUPT indicator and place the Model 41-3A in a system ready status.

4.07 Following a system ready message, a CTRL Z can be used at any time to cause a system reset condition. The CTRL Z reset has the same effect as momentary Model 41-3A power interruption. Approximately 5 seconds are required to implement a CTRL Z system reset (more time may be required if the Model 41-3A is used with a 5900-00-920/921 tape drive).

C. System Ready

4.08 The system ready mode is the access to all other control modes of the Model 41-3A with ERC. (The Model 41-3A can also be operated from its own panel controls while in the system ready mode.)

4.09 Prior to a ready condition, the Model 41-3A transmits a rewind command which directs the tape drive (if present) to rewind its cassette. Therefore, a busy message usually precedes a ready indication at the terminal. When equipped for SIT signal detection, the 41-3A also transmits the message "SIT Option is installed and operating" to inform the user that the SIT feature is operational (See Fig. 37).

4.10 While in the system ready mode, an operator can request a displayed list of proper mode commands by typing the H key (see Fig. 37). Additional messages and instructions appear as other control modes are implemented. The Model 41-3A automatically returns to a system ready condition following execution of certain functions and keyboard entries.

D. ID Code

4.11 Key I is used to obtain the ID programming mode (see Fig. 39). A code or name can then be assigned to identify either the Model 41-3A unit in use or its stored call program. This identification code is then presented with other appropriate messages or reports.

4.12 The indication **NOT PROGRAMMED** appears when no code has been previously assigned. If previously assigned, the programmed ID code appears in place of this negative indication. The instruction to set the identification code is ignored if no change in the assigned code is required. Pressing the RETURN key (indicated as a < RET > entry) returns the Model 41-3A to the system ready mode.

4.13 An ID code consists of up to 14-alphanumeric characters (including spaces). As shown in the example, Table K, each character is displayed as keyed. Either the 14th character or a < RET > stores the assembled code in the memory of the Model 41-3A. A confirmation is presented before the Model 41-3A returns to the system ready condition. The ID mode is used as often as needed to change the ID code.

E. System Time and Date

4.14 The time and date mode (key T) is used to set the internal 24-hour clock of the Model 41-3A. Both the current unit ID code and system time and date are shown in the mode display (see Fig. 41). Ignore the instruction to set the time and date if no change is required. Keying a < RET > at this time returns the Model 41-3A to the system ready mode.

4.15 The entry format for time and date is a sequence of two-digit entries for hour, minute, month, day, and year. Table L provides programming examples. Note that no spaces are keyed between the hour, minute, month, day, and year entries. The delineators colon (:), space, and dash (–) are automatically inserted in the time and date display. If a < RET > is keyed before a complete 10–digit entry is made, the time and date mode is exited without change to the current time and date display.

TABLE K

ID CODE EXAMPLE

ENTRY	DISPLAY
SXS < SP > CO < SP > UNIT < SP > A1	> SXS CO UNIT A1 41-3A ID: SXS CO UNIT A1
Note: In the above example entry, < SP > designates a SPACE BAR entry.	

TABLE L

TIME AND DATE EXAMPLES

TIME AND DATE	ENTRY FORMAT	DISPLAY
12:30 am, December 16, 1985	0030121685	00:30 12-16-85
12:30 pm, December 16, 1985	1230121685	12:30 12-16-85
Note: A correct time and date entry is based on a 2400-hour and calendar year (including leap year) period. No error checking is done on time or date entries.		

F. Edit Mode

4.16 The purpose of the edit mode is to allow a keyboard operator to assemble and store an initial test call program into the Model 41-3A. This mode can be used to delete, modify, or replace a program already stored in the Model 41-3A.

> *Note:* The operate and data transfer modes provide alternate ways of loading a test call program into the Model 41-3A.

4.17 A test call program is a set of instructions which direct the automatic dialing operations of the Model 41-3A. There are two types of instructions:

(a) switch control instructions which specify test parameters for one or more address instructions

(b) address instructions which specify the number of calls to a designated address (telephone number).

4.18 Instructions vary in length (number of characters). Therefore, the total number of instructions which can be stored depends on how many individual switch control and address instructions are programmed by an operator. The total maximum limit varies from 85 to 256 instructions. (A test call program could consist of a single instruction.)

4.19 Press key E to enter the edit mode. Following the edit mode message (see Fig. 43), the edit prompt (>) is positioned at the first storage location of the memory space. If a test call program is already present in the 41-3A, its first instruction normally (but not necessarily) begins at this first storage location. The instruction is displayed just above the edit prompt and cursor ([ ). The position of the edit prompt is maintained until an instruction is assembled and stored, or the edit prompt is deliberately repositioned (moved forward or backward) by the operator.

4.20 Prior to editing an instruction, the operator can use key H to obtain an edit command menu (see Fig. 45). This menu lists the commands available for programming (or editing) a test call program. (The previous position of the edit prompt is maintained when this menu is displayed.)

4.21 Switch Control Mode

> *Note:* A switch control instruction overrides the control functions of many—but not all—front mounted controls of the Model 41-3A. The panel controls not overridden by programmed instruction continue to affect the operation of the Model 41-3A during its execution of a test call program. As a precaution, all Model 41-3A front panel controls should be preset for acceptable values and conditions (refer to item 2.39, Model 41-3A Settings).

4.22 Before entering the switch control mode, a display of the format used to assemble a switch control instruction can be obtained by pressing key F. The functions and selections listed in this display (see Fig. 46) are explained in detail in Table M. (The last position of the edit prompt is also maintained when this menu is displayed.)

4.23 Press key S to enter the switch control mode. The letter S appears after the edit prompt to indicate entry into the switch control mode. At this point, if a previously stored instruction is displayed immediately above the edit prompt, it can be removed (cleared) from memory by keying a < RET >. Otherwise, keying a 1, 2, or 3 (for S#) sets the start dial function for a new instruction. Other function designators (D, F, H, and T) are automatically displayed. An L or C designator appears only if a 1-kHz tone or a C-message selection is programmed for the T (TEST OK on) function.

> *Note:* No SIT programming prompts are provided in the switch control mode. When equipped with the SIT detection feature, the Model 41-3A automatically monitors a line under test for SIT signal conditions. The detection of a valid SIT signal is considered a fault regardless of test OK and other call completion results.

4.24 A designator for the line select function is not given. Key a < RET >, or an A and B and < RET >, to select both channels and all lines. Press A or B and < RET > to select all lines of the A or B channel. Enter A or B, a line number (0, 1, . . ., or 7), and < RET > to select only one of the channel A or B lines.

4.25 An assembled instruction is stored in the memory of the Model 41-3A when the < RET > of a line select entry is keyed. The instruction is stored in the program location positioned by the edit prompt. Any instruction present in that location is replaced by the new instruction. The stored instruction is displayed with an appended asterisk (e.g., S1D2F3H0002T11-88C30B2*), and the edit prompt then moves forward to the next program location.

4.26 Each switch control instruction is normally followed by one or more associated address instructions. As instructions are stored in sequence, the edit prompt is advanced toward the end of the Model 41-3A's memory space. The message **NOT ENOUGH MEMORY LEFT FOR SWITCH/CONTROL ENTRY** is transmitted if additional switch control instructions can no longer be programmed. At this point, only an additional address instruction can be programmed.

TABLE M

SWITCH CONTROL FUNCTIONS

<table>
<tr><th>FUNCTION</th><th>EXPLANATION</th></tr>
<tr><td>START DIAL
(S#)</td><td>The start dial function programs one or both of two start dial conditions and replaces the control functions of the DELAY and DIAL TONE pushbuttons (START DIAL COMMAND). Possible selections are as follows:
<table>
<tr><th>SELECTION</th><th>PURPOSE</th></tr>
<tr><td>1</td><td>This selection permits dialing to begin after a preset time interval expires following a line seizure (off-hook indication). Also, when an address (dialing number) instruction contains a wait-for-start-dial (W) condition, the same delay condition must be satisfied before dialing can resume. The preset time interval is determined by the START AFTER control setting on the Model 41-3A.</td></tr>
<tr><td>2</td><td>This selection allows dialing to begin or resume upon receipt of dial tone. This dial tone selection includes wink and similar MF start dial signals; dialing begins or resumes when a dial tone or wink is received.The maximum wait interval for a dial tone indication is determined by the START AFTER control setting.</td></tr>
<tr><td>3</td><td>This selection programs the Model 41-3A to:
(a) begin dialing when dial tone (or an MF wink signal) is received after an initial off-hook indication, and
(b) when a W is programmed, to resume dialing after a preset time interval expires (the time interval is determined by the START AFTER control setting). If, for example, 603WWWW2256511 is programmed for dialing and the START AFTER control is set for 2 seconds, then after 603 is dialed, a delay of 8 seconds (WWWW x 2 sec) follows before 2256511 is dialed.</td></tr>
</table></td></tr>
</table>

TABLE M (Cont'd)

<table>
<tr><th>FUNCTION</th><th>EXPLANATION</th></tr>
<tr><td>DIAL TYPE
(D#)</td><td>This function programs the type of dialing and replaces the control function of the TT/MF/DP toggle switch (DIALER PROGRAM). The dial pulse (DP), dual-tone multifrequency (TT), or multifrequency (MF) dialing selections require various presettings of the SPEED, % BREAK, and IDT thumbwheels, and of the LEAK/LOOP switches. Possible selections are as follows:
<table>
<tr><th>SELECTION</th><th>PURPOSE</th></tr>
<tr><td>1</td><td>This DP (dial pulse) selection requires appropriate settings of the SPEED, % BREAK, and IDT thumbwheels, and of the LEAK/LOOP switches.</td></tr>
<tr><td>2</td><td>This DTMF (dual-tone multifrequency) selection requires appropriate settings of the SPEED and % BREAK thumbwheels.</td></tr>
<tr><td>3</td><td>This MF (multifrequency) selection requires appropriate settings of the SPEED and % BREAK thumbwheels.</td></tr>
</table></td></tr>
<tr><td>FAULT ON
(F#)</td><td>The fault function replaces the control functions of the OPEN C-LEAD and REV DRNG-DIAL pushbuttons, and programs none, one, or both of two conditions which will cause a fault condition. Possible selections are as follows:
<table>
<tr><th>SELECTION</th><th>PURPOSE</th></tr>
<tr><td>0</td><td>When this selection is made, the Model 41-3A ignores an open C-lead or tip/ring polarity reversal during dialing.</td></tr>
<tr><td>1</td><td>This selection causes a fault condition when an open C-lead is detected.</td></tr>
<tr><td>2</td><td>This selection causes a fault condition when a tip/ring polarity reversal is detected during dialing. (The T/R reversal discloses reversed wipers in SXS switch trains and faulty message accounting equipment.)</td></tr>
<tr><td>3</td><td>This selection causes a fault condition when an open C-lead or a tip/ring polarity reversal during dialing is detected.</td></tr>
</table></td></tr>
<tr><td>HOLD ON
(H####)</td><td>This function sets conditions which cause the Model 41-3A to halt operation and hold the line under test. The HOLD ON pushbuttons replaced by this function are REORDER, BUSY, R or B + ANSWER, and FAULT. A 4-digit selection entry (####) is required.

Single or combined reorder, busy, and fault hold conditions as well as a no-hold condition can be selected. A no-hold condition is programmed only when the #### entry contains all zeros, i.e., #### = 0000. Any digit sequence other than four zeros sets one or more hold conditions. For example, entry 0002 programs a busy hold condition, whereas entry 1200 sets both a reorder and busy hold condition.</td></tr>
</table>

TABLE M (Cont'd)

FUNCTION	EXPLANATION
HOLD ON (H####) (Cont'd)	A reorder selection programs the Model 41-3A to halt when a reorder tone is received without a false tip/ring polarity reversal (answer) indication. The reorder selection is programmed by placing digit 1 in one or more positions of the #### format, e.g., 1000, 0100, 0010, 0001, 1100, 1010, 1001, etc. A busy selection causes a halt when a busy tone is received without a false tip/ring polarity reversal (answer) indication. The busy selection is programmed by placing digit 2 in any or all digit positions of the #### format, e.g., 2000. 0200, 0020, 0002, 2200, 2020, 2002, etc. A combined answer and reorder or busy selection programs the Model 41-3A to halt when a false tip/ring polarity reversal (answer) indication and a reorder or busy tone are received. This selection is programmed by placing digit 4 in any or all positions of the #### format, e.g., 4000, 0400, 0040, 0004, 4400, 4040, 4004, etc. A hold on fault selection programs the Model 41-3A to halt when a fault is detected. A fault can be a no dial tone (or no wink) condition, a detected SIT signal, a selected FAULT ON result, or a programmed TEST OK ON violation. The hold on fault condition is programmed by placing digit 8 in any or all positions of the #### format, e.g., 8000, 0800, 0080, 0008, 8800, 8080, 8008, etc.
TEST OK ON (T####)	This function programs call completion conditions. It replaces the control functions of the ANS SUP, 1KHZ TONE, and INC CKT pushbuttons. It is also used to select a C-message noise test. TEST OK (and other call completion) requirements must be met without detection of a SIT signal in order to record a TEST OK result for a test call. Single or various combinations of answer supervision, 1-kHz level, incoming circuit, and C-message noise level detection requirements can be programmed. A 4-digit selection entry #### is required The ANSWER supervision selection requires the detection of a tip/ring polarity reversal. This selection is programmed by placing digit 1 in any or all digit positions of the #### format, e.g., 1###, #1##, ##1#, ###1, 11##, #11#, ..., 1111. (Note that with a 1111 entry, no other test complete requirement is programmed.) The milliwatt signal source for the 1-KHZ TONE selection can be the Model 41-3A's built-in test line or another source (such as Test Line Type 102, or Network System Support Division types TTS 39 and 52) which can provide a milliwatt signal for a duration of at least 1700 milliseconds. The 1-kHz selection is programmed by placing digit 2 in any or all digit positions of the #### format, e.g., 2###, #2##, ##2#, ###2, 22##, #22#, ..., 2222. (Note that with a 2222 entry, no other test complete requirement is programmed.) The INC CIRCUIT selection requires the detection of a completed call to the internal test line of the Model 41-3A; therefore, the INCOMING CIRCUIT terminals must connect to an incoming circuit. This selection is programmed by placing digit 4 in any or all digit positions of the #### format, e.g., 4###, #4##, ##4#, ###4, 44##, #44#, ..., 4444. (Note that with a 4444 entry, no other test complete requirement is programmed.)

TABLE M (Cont'd)

FUNCTION	EXPLANATION
TEST OK ON (T####) (Cont'd)	The C-message measurement function applies only to test line types (such as newer versions of Test Line Type 100) which provide a milliwatt signal presence for a minimum of 1700 milliseconds, followed by a signal-quiet interval of 2500 milliseconds. The C-message selection is made by placing digit 8 in any or all digit positions of the #### format, e.g., 8###, #8##, ##8#, ###8, 88##, #88#, . . . , 8888. (Note that with an 8888 entry, no other test complete requirement is programmed.)
1-KHZ WINDOW (L######)	This function is used to program the min/max level requirements for detection of a milliwatt signal when the 1-KHZ LEVEL parameter is selected as a TEST COMPLETE requirement. The range of level measurement is −30 to +10 dBm. The detection window is set by keying consecutive min and max entries, each consisting of a +/− sign and 2-digit value. The entry +10–09 specifies window limits of −9 to +10 dBm.
C-MESSAGE LEVEL (C##)	This function is used to program the level requirement for noise detection when the C-MESSAGE TONE parameter is selected as a TEST COMPLETE requirement. The range of level measurement is 15 to 55 dBrnC. The threshold level is set by keying a 2-digit value. Entry 25, for example, specifies an upper noise threshold of 25 dBrnC.
LINE SELECT	The channel and line function determines which input channel (A or B, or both) and associated telephone line/s (0 through 7) of the Model 41-3A are internally engaged for testing. It replaces the control functions of the A TEST or B TEST pushbutton. Line select is the last function of a switch/control instruction. No designator is displayed for this function. Depending on selections made for the test complete function, the line select function is programmed following the parameter entry for the test complete, 1-kHz window, or C-message function. Both channels and all (16) lines are selected either by keying a <RET> or entering AB followed by a <RET>. A single channel (8 lines) is selected by entering an A or B followed by a <RET>. A single line is selected by entering an A or B (channel) and a line number (# = 0, 1, . . . , 6, or 7), followed by a <RET>.

4.27 Edit Address Mode

4.28 The edit address mode is used to program an address instruction into the test call program of the Model 41-3A. This mode can also be used to delete or replace a previously stored instruction. The edit address mode can only be used by first entering the edit program mode. Prior to keying the address mode command, a display of the format used to program an address instruction can be obtained by pressing key A. This display (see Fig. 48) defines the structure of an address instruction. (The last position of the edit prompt is not changed by this display.)

4.29 As shown by the address format display, an address instruction contains the number of test calls to be made and the telephone number to be dialed. The specified telephone number can also contain "wait for start dial" (W) codes and a special "end of number" (E) code. Normally, a switch control instruction is programmed prior to programming a group of one or more address instructions.

4.30 Press key N to request the edit address mode; the letter N is displayed to indicate entry into the address mode. Then enter a number from 1 to 9999 to set the number of times a telephone number is to be dialed. Use the comma key to separate this number from the address digits which are programmed next. The test number should be a number necessary to reach a type 102 or other suitable test line. When the internal test line of the Model 41-3A is used, the address is the number of the incoming circuit connected to the 41-3A.

> *Note:* When the 41-3A contains a previously stored call program, an instruction (switch control or address) may appear immediately above the letter N. (Such an instruction will appear immediately above the address format display if it was requested just prior to the edit address mode.) This instruction can be cleared (removed from the call program) at this point by keying a <RET >, otherwise, it will be replaced if a new address instruction is immediately programmed after the letter N is displayed.

4.31 A test call number can consist of up to 32 digits and codes. In addition to dial digits 0 through 9, the Touch-Tone® dial codes * (asterisk) and # (octothorpe) can also be used. (Touch-Tone® dial codes A, B, C, and D cannot be programmed.) The MF dialing codes KP and ST are not programmed with address digits; the 41-3A automatically transmits these codes at the proper time. Program W and E codes within the address as needed; the entry 9W2246511, for example, programs a wait-for-start-dial (W) condition after the digit 9 is dialed. For CAMA-ANI digits, code E separates the called party number from the calling party number (up to 16 characters). It is not necessary to place an E at the end of the calling party number.

> *Note:* Dial codes * and # should be used only for Touch-Tone® dialing. Programmed * and # codes are ignored by the Model 41-3A dialer when MF or DP dialing is used.

4.32 The DELETE (or RUB OUT) key is used to remove an incorrectly keyed digit or code. A deletion mark (\) appears next to the character to be deleted. Characters are deleted from right to left. For example, digits 3 and 7 are marked for deletion from the assembled instruction N44,237\7\2256511 with the result that N44,2246511 is the instruction to be stored.

4.33 If the 32-digit/code limit of a test call number is exceeded, the message **ERROR MODE CONDITION** appears and the address instruction is aborted. If the message **NOT ENOUGH MEMORY LEFT FOR SWITCH/ CONTROL ENTRY** appears, only an address instruction containing 16 or less characters can be stored. All characters beyond the 16th character are automatically deleted.

4.34 Use the < RET > key to store an assembled address instruction. The instruction is stored in the program location positioned by the edit prompt. Any instruction previously stored in that location is replaced by the new instruction. The stored instruction is displayed with an appended dollar mark (e.g., N50,9W2246511$), and the edit prompt moves forward to the next program location.

4.35 Other Edit Commands

4.36 Several editing functions are provided in addition to the switch control and address instruction modes discussed above. The CTRL U command, for example, allows the operator to abort a partially assembled instruction prior to its being stored in memory. (The memory position of the edit prompt is not changed by this action.)

4.37 The move forward and backward commands, CTRL F and CTRL B, allow the edit prompt to be selectively positioned in the program memory space. For example, beginning with the first instruction of a stored program, a sequential display of the call program can be obtained by keying repeated CTRL F commands.

4.38 Keying a CTRL F entry places the edit prompt in a move-forward mode, as indicated by the letter f which appears next to the edit prompt (>f). Next, another CTRL F, or a number from 0 to 999, < RET >, or a CTRL U determines how the edit prompt is advanced through the program. Pressing the key 0 (zero) and < RET >, or just a < RET > alone, causes an exit from the mode without any advancement through the stored program. A complete three digit entry, or a one/two digit entry and < RET >, causes the edit prompt to scroll (sequentially move forward) the number of instructions designated, or until the last memory location is reached. The scroll defaults to 250 for an entry value between 250 and 999. This scroll action is stopped by a **CTRL S**. The message **STOPPING SCROLL FUNCTION AND JUMP TO TARGET ENTRY** appears, and the prompt is moved directly to the instruction location designated. Repeated CTRL F entries move the edit prompt forward instruction-by instruction. The move-forward mode and a move-forward entry can be aborted with a CTRL U.

4.39 The move-backward mode (CTRL B) functions in the same manner as the move-forward mode described in the previous paragraph, except that movement is reversed (as indicated by the letter b which appears next to the edit prompt, >b). These two modes of the edit function are used to position the edit prompt so that selected instructions can be reprogrammed by use of the S or N command mode, or removed by use of the S< RET > and N< RET > commands (press S or N key, then the RETURN key). Notice also, that all instructions stored forward of the last displayed instruction can be removed by a simple CTRL C entry.

G. Report Mode

4.40 The Model 41-3A with ERC provides two basic types of reports:

(1) a call report on an individual test call

(2) a summary report which totals the results for one or more test calls.

Note: The above general report types are discussed in greater detail under the headings CALL REPORT and SUMMARY REPORT (paragraphs 4.48 and 4.54).

4.41 The Model 41-3A automatically sends out a summary report following the complete execution of an address instruction. These reports are retained in the 41-3A's internal memory for later retrieval. A call report is automatically transmitted only when the Model 41-3A halts a dialing operation because of a programmed hold condition. These call reports are not retained for later retrieval.

4.42 In addition to the above routine reports, the report mode allows the operator to request reports and to store these reports in memory.

Note: An additional report mode is provided by the command listed as Command S in the 41-3A Remote Service Analyzer Command Menu, (see Fig. 35 and 38). This report mode is discussed under the subject heading Summary Request (part J).

4.43 Press key R to obtain the report mode (see Fig. 52). Once in the report mode, key R can be used to obtain a list of report mode commands (Fig. 53). Also, key S can be used to display the current request status (Fig. 54).

4.44 A report request is made by pressing the appropriate key (A, E, or H) listed in the report menu. The Model 41-3A remains in the report mode so that other requests can be made.

4.45 Press key A to request a call report for each call attempted regardless of test results. Press key E to request a call (exception) report for a test call not resulting in a TEST OK. Press key H to request the transmission of a summary report every hour on the hour. Normally, reports list only those test results which occur while executing an address instruction; if desired, press key X to obtain a complete list of possible test result categories when a summary report is transmitted. This category request does not apply to SIT signal categories—only actual SIT test results are listed in any report. Requested A, E, H, or X reports are retained in memory only if key D is also pressed.

Note: Although all reports are transmitted, the Model 41-3A has sufficient memory to guarantee at least 200 reports (call or summary) can be retained at any one time for later retrieval. Report and store requests must be made carefully, as a single address instruction could result in thousands of reports.

4.46 Requested hourly reports can be cancelled by a CTRL H, and the CTRL P command cancels all other requested reports. Command CTRL C resets test result accumulators so that summary reports then provide only current data. The CTRL B request removes all reports presently stored in memory.

4.47 Enter a < RET > to exit the report mode and return to a system ready condition.

4.48 Call Report

4.49 A call report may be a requested call or exception report, or a report transmitted because of a hold condition. In general, a call report gives the following information:

- 41-3A system ID code
- time and date of the call
- which A or B channel was used
- dialing mode used
- test result
- digits dialed (CAMA-ANI calling party digits are shown below the called party digits).

4.50 An example call report is given in Fig. 58.

4.51 When a TEST OK indication is not given as the test result, the reason for the call completion failure is given instead. Possible completion failures include the following:

1. NO DIALTONE — no dial tone (or wink-type start-dial) signal

2. OPEN C-LEAD — open C-lead after line seizure

3. REV DRNG DL — T/R polarity reversal occurred during dialing

4. REORDER — reorder signal received

5. REORDER+ANS — false answer and reorder signal received

6. BUSY+ANS — false answer and busy signal received

7. BUSY — station busy signal received

8. LOW LEVEL — low 1-kHz level

9. NO 1KHZ — no 1-kHz tone

10. HIGH LEVEL — high 1-kHz level

11. NO ANSWER — no answer supervision was received

12. INC CKT FLT — incoming circuit fault

13. C-MESSAGE — low C-message noise level

14. SIT — Special Information Tone signal received.

15. NO PROMPT — no prompt tone signal

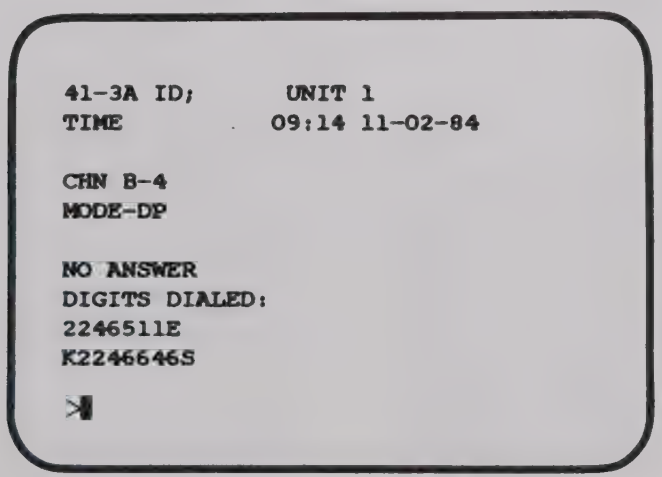


Fig. 58 — Call Report Example

TABLE N

SIT SIGNALS

REPORTED TEST RESULT	SIGNAL NAME	USER	SEGMENTS 1,2,3 FREQ.	SEGMENTS 1,2,3 PW	REPORTED TEST RESULT	SIGNAL NAME	USER	SEGMENTS 1,2,3 FREQ.	SEGMENTS 1,2,3 PW
SIT 00			LLL	SSS	SIT 16			LHL	SSS
SIT 01			LLL	LSS	SIT 17			LHL	LSS
SIT 02			LLL	SLS	SIT 18			LHL	SLS
SIT 03			LLL	LLS	SIT 19			LHL	LLS
SIT 04 IC	INTERCEPT	BOC	LLL	SSL	SIT 20			LHL	SSL
SIT 05			LLL	LSL	SIT 21			LHL	LSL
SIT 06			LLL	SLL	SIT 22 RO	REORDER	BOC	LHL	SLL
SIT 07 NC	NO CIRCUIT	IEC	LLL	LLL	SIT 23			LHL	LLL
					SIT 24			HHL	SSS
SIT 08			HLL	SSS	SIT 25			HHL	LSS
SIT 09			HLL	LSS	SIT 26			HHL	SLS
SIT 10			HLL	SLS	SIT 27			HHL	LLS
SIT 11			HLL	LLS	SIT 28			HHL	SSL
SIT 12			HLL	SSL	SIT 29			HHL	LSL
SIT 13 VC	VACANT CODE	BOC	HLL	LSL	SIT 30			HHL	SLL
SIT 14 RO	REORDER	IEC	HLL	SLL	SIT 31 NC	NO CIRCUIT	BOC	HHL	LLL
SIT 15			HLL	LLL					

Notes:

1. BOC = Bell Operating Companies
   IEC = Interexchange Carrier

2. The L, H, and S (frequency and pulse-width) codes are defined as follows:

SEGMENT	FREQUENCY (Hz, +/− 1.5 %) LOW	FREQUENCY (Hz, +/− 1.5 %) HIGH	PULSE WIDTH (ms., +/− 5 %) SHORT	PULSE WIDTH (ms., +/− 5 %) LONG
1	913.8	985.2	274	380
2	1370.6	1428.5	274	380
3	1776.7	———	274	380

4.52 If the threshold level of a programmed C-message function is exceeded, the actual measured level is shown (in dBrnC) on the right side of a C-MESSAGE indication. Detected noise levels are rounded up at the half dB point. For example, values from 26.5 to 27.4 dBrnC are shown as digits 27. The Model 41-3A requires at least 4000 milliseconds of detected milliwatt signal time and at least 5000 milliseconds of quiet (no signal) time during which noise level is measured. Noise measurement begins 2500 milliseconds after the end of milliwatt and is conducted over a maximum period of 1000 milliseconds. The milliwatt measurement period must be completed in such a time that the total duration of a test call does not exceed 4 times the setting of the NETWORK DLY control. If a proper milliwatt signal is detected, but an insufficient quiet (absence of signal) interval is measured, the number 99 is given in a report. When a proper milliwatt signal is not detected, the exception report indicates a NO 1KHZ test result.

4.53 When a detected 1-kHz signal level falls outside the programmed window limits of the 1kHz Tone function, the measured dBm value is shown on the right of the LOW or HIGH LEVEL test result. Detected levels are rounded up at the half dB point. For example, a +6.5 to +7.4 measured dBm is shown as digit 7. If 4000 milliseconds of signal duration is not detected during a time span equal to 4 times the setting of the NETWORK DELAY (front panel) control, a NO 1KHZ test result is reported.

> *Note:* Set the front panel NETWORK DELAY time at approximately 15 seconds for 1-kHz tone and C-message noise measurements to ensure a correct test response.

4.54 In agreement with AT&T Compatibility Bulletin CB154, the Model 41-3A detects a SIT (Special Information Tone) signal as a series of tone pulses, designated as segments 1, 2, and 3. The frequencies and pulse widths (tone durations) of the segments determine which one of 32 valid signal categories is assigned to a detected SIT. Presently, only four SIT signals are used by the exchange network. These SITs are used as tone prefixes to recorded announcements for reorder, vacant code, no circuit, and intercept conditions. Also, two SITs are used in interLATA carrier traffic applications for reorder and no-circuit conditions. The remaining SIT signals are not presently used.

4.55 Table N lists 32 test result categories used by the Model 41-3A to report SIT signals. For example, a high-high-low (HHL) frequency sequence together with a long-long-long (LLL) pulse-width sequence is reported as a "SIT 31 NC" signal.

4.56 SIT signal detection begins at the start of the AWAITING TEST RESULTS period and stops when either the TEST OK or NETWORK DELAY period ends. A received SIT signal must start and end within this time interval in order to be detected as a valid SIT signal. Detection of a valid SIT signal nullifies a TEST OK condition and causes a call failure result.

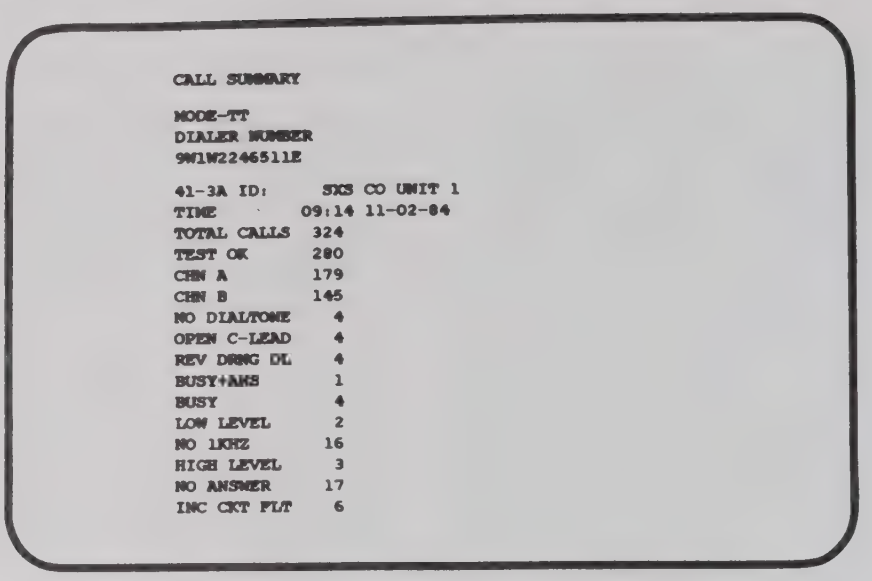
4.57 Only digits successfully dialed are shown in a call report. An E terminates all digits for the DP or TT mode. A wait for start dial (W) is shown in proper position with the dialed digits. All MF digits are preceded with a K and terminated with an S to indicate respective KP and ST code tones. Dialed digits are shown on two lines to include both called party digits and CAMA-ANI calling party digits.

4.58 Summary Report

4.59 The heading CALL SUMMARY precedes a summary report. Information is listed from top to bottom as follows:

- dial mode
- dialed number (called party digits are shown above CAMA-ANI calling party digits, if any)
- 41-3A ID code
- time and date of report
- 17 result categories with total counts (if any)
- SIT signal counts (only when relevant)
- overflow messages (if any).

4.60 An example summary report is given in Fig. 59. The example shown is a normal summary report; i.e., only test results which actually occurred are shown. When all calls of an address instruction result in a TEST OK, no other test results appear after the CHN A and/or CHN B categories. Except for SIT categories, a list of all possible test results can be requested via the report mode. No SIT signal counts appear in the example of Fig. 59—only detected SIT signals are given in any summary report. Also, because the detection of a SIT signal nullifies a call's TEST OK result, SIT counts are not included in the total TEST OK count.



```
CALL SUMMARY

MODE-TT
DIALER NUMBER
9W1W2246511E

41-3A ID:      SXS CO UNIT 1
TIME        09:14 11-02-84
TOTAL CALLS  324
TEST OK      280
CHN A        179
CHN B        145
NO DIALTONE    4
OPEN C-LEAD    4
REV DBNG DL    4
BUSY+ANS       1
BUSY           4
LOW LEVEL      2
NO 1KHZ       16
HIGH LEVEL     3
NO ANSWER     17
INC CKT FLT    6
```

Fig. 59 — Summary Report Example

4.61 The DIALED NUMBER is shown as programmed in the address instruction. The W indicators are included with dialed digits. All DP and TT mode numbers end in an E. All MF numbers are enclosed with K and S designators. Calling party numbers (if any) are shown below called party numbers. Each test result category is listed even when no total counts are shown. An overflow message appears only when the Model 41-3A attempts to store counts for more than 9,999 test calls.

H. Operate Mode

4.62 Press CTRL O (letter O) to obtain the operate mode (see Fig. 55). Once in the operate mode, pressing key H provides a menu of mode commands (Fig. 56). An **EXIT OPERATE MODE** message is transmitted when digit O is keyed.

4.63 The operate mode is used to execute a test call program. There are three ways (digit commands 1, 3, and 5) to execute the call program currently stored in the Model 41-3A. Two ways (commands 4 and 5) are provided to run a taped program. The message **PROGRAM RUNNING** notifies the operator that a call program is being executed. Appropriate call and summary reports are also transmitted.

4.64 Operate Commands

4.65 Operate commands 1 and 3 are the same except that a future start time and date must be set if digit 3 is selected. After the message **Set operate start time and date**, enter 2-digit numbers for the hour, minute, month, day, and year. For example, number sequence 1900123085 sets the program execution time for 7 p.m. on December 30, 1985.

4.66 Operate command 5 is the same as command 1, except that the digit 5 selection is intended for use with a printer which requires "wakeup" time to come up to speed and time to complete a carriage return.

> *Note:* If command 1 is selected and characters are lost at the beginning of a report printout or at the start of each line, then operate command 5 should be used in place of command 1.

4.67 Keying digit 4 is the same as keying digit 2, except that command 4 requires a specified start time as explained for a digit 3 operation. In either case, the taped program is first loaded into the Model 41-3A, then executed. (The new program replaces a previously stored program.) If the 41-3A detects a transmission error in the program data, it sends the message **ERROR MODE CONDITION** and a prompt >. The 41-3A then pauses 3 seconds before requesting another transmission from the tape drive. This action continues until proper data is received, or until any keyboard entry during the 3-second pause causes the 41-3A to abort the operate mode.

4.68 Hold Conditions

4.69 The running of a call program is interrupted by keying a CTRL O command. The Model 41-3A transmits a summary report and the message **413A HELD — ALARM RESET** message. A "beep" is also transmitted to the terminal. Press key 6 to release this hold condition and continue the program, press key 7 to execute the next (if any) address instruction, or press 8 to stop the program and return to a system ready condition. (Appropriate summary reports are transmitted in conjunction with these commands.)

4.70 If the Model 41-3A detects a programmed hold condition, it transmits an exception report and the message **413A HELD — ALARM SET**. An alarm tone is also sounded at the Model 41-3A. Press key 6 or 7 to silence the alarm at the Model 41-3A. After transmission of an alarm reset message, key digit 6 or 7 to continue, or an 8 to stop the program.

I. Data Transfer Mode

4.71 Press key D to enter the data transfer mode. The Model 41-3A transmits a **DATA TRANSFER MODE** message which includes an optional help instruction (type H). When keys D and H are pressed, the transmitted message is as shown in Fig. 60 below. Notice that keying digit 0 results in an immediate exit from the data transfer mode.

4.72 Figure 61 below illustrates a dump-program transfer. Mode command 1 was keyed for this example. Only this selection results in an instruction to label or name the program to be taped. For this example, the program was labeled by keying the entry PROGRAM NO. 1 and a <RET>. If a label is not needed, just enter a <RET>. Key a CTRL U to abort a partial entry. The transmission is shown to the right as it appears on a video terminal. Brief explanations are given to the left of the transmitted elements. Busy messages and control characters sent for other transfer operations are similar to those shown in Fig. 61, but program or report content depends on prior operations and the type of transfer.

```
DATA TRANSFER MODE

Type H to display DATA TRANSFER COMMANDS.

>

DATA TRANSFER COMMAND MENU

 COMMAND  :  DESCRIPTION
-------------------------------------------------------------
    0     |  Exit without data transfer.
          |
    1     |  Format tape and dump program to tape
    2     |  Dump program to host device.
    3     |  Dump program and data from tape.
    4     |  Dump report data from 41-3A (Formatted).
    5     |  Dump report data from 41-3A (Formatted) to tape.
    6     |  Dump report data from 41-3A (Unformatted).
          |
    7     |  Load program from tape into 41-3A.
    8     |  Load program from host device into 41-3A.
-------------------------------------------------------------
>
```

Fig. 60 — Data Transfer Command Menu

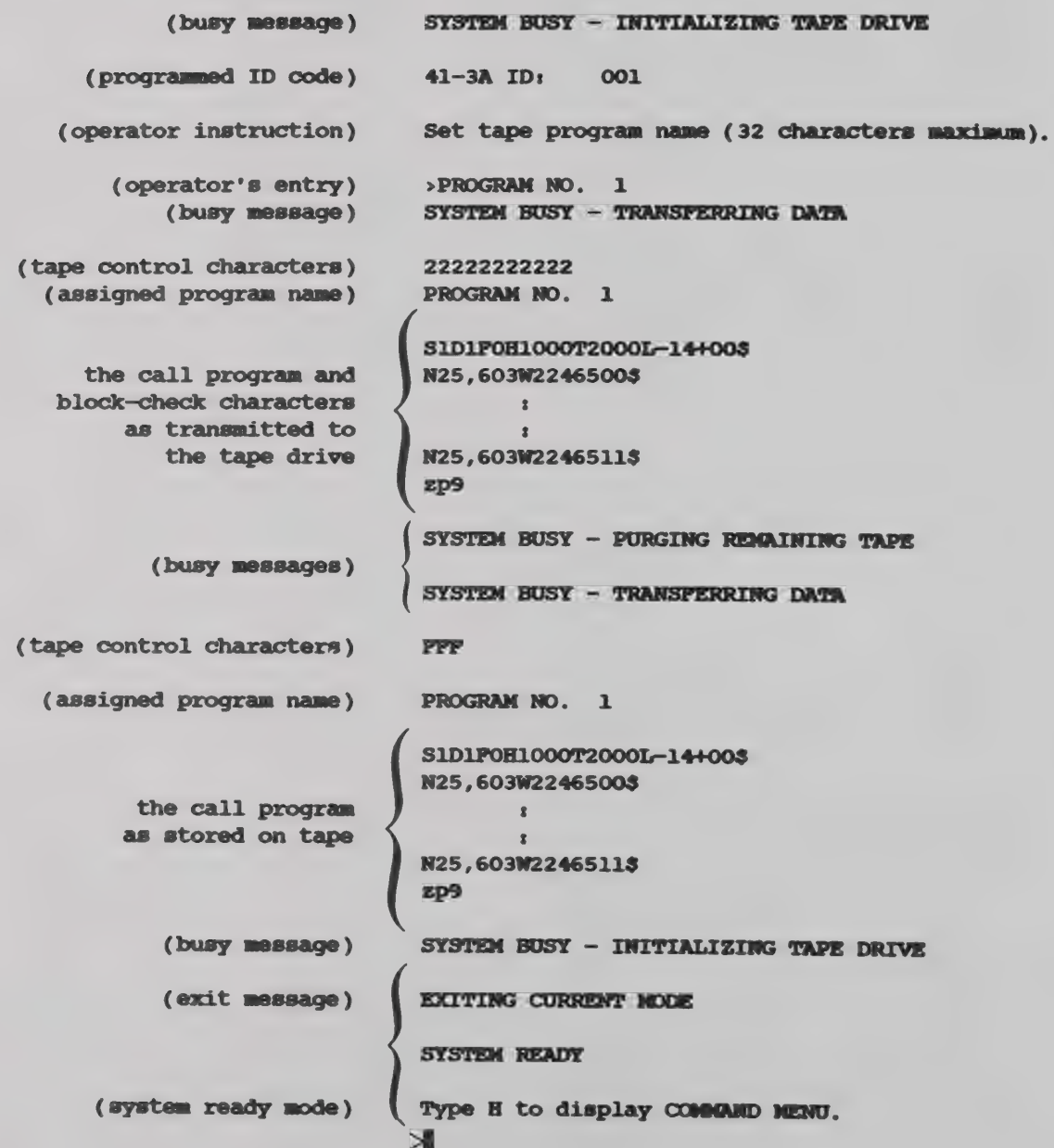


Fig. 61 — Transfer Example

4.73 As indicated in Fig. 60, test results can be formatted into call and summary reports which include test categories, space tabs, carriage returns, line feeds, etc. Test results can also be unformatted (a stream of raw data without categories, tabs, etc.) for use by a host computer (micro, mini, etc.).

4.74 When the Model 41-3A transfers its call program (dump commands 1 and 2), or transfers unformatted test data (command 6), it includes block-check characters to facilitate error detection by a host computer. The Model 41-3A itself performs an error detection routine on the program sent to tape via command 1. It also performs an error detection routine on a program received via command 7 or 8. If an error is detected, it transmits the message **MODE ERROR CONDITION**. Therefore, block-check characters must be generated by the host computer when it loads the Model 41-3A. The generation of block-check characters is discussed in detail under subject heading "Computer/41-3A Communication Requirements" (part 3K).

> *Note:* The MODE ERROR CONDITION message is also transmitted for invalid command conditions. For example, the message appears if a request is made to store information on tape when a tape drive is not used. (Only the MFE Model 2500 cassette tape drive can be used with the Model 41-3A.)

4.75 Prior to dumping formatted data to tape, reports stored in the Model 41-3A can be transmitted to the terminal for a display/printout (command 4). After a call program and/or formatted data are stored on tape (commands 1 and 5), the tape's content can be viewed at the terminal (command 3).

4.76 The Model 41-3A does not perform error detection for information transmitted to the terminal via commands 3 and 4, and the transmission of such information can be interrupted. A prompt (—) appears after the call program and after each report. An approximate 2-second delay follows the prompt before transmission resumes. If any keyboard character is pressed within the delay period, the transfer of other information is prevented. This interruption remains until key C is pressed to continue the transmission, or until key S is used to stop the transfer operation and to cause a return to the system ready condition. In the case of a transmitted report (command 4), pressing key R allows a repeat of the last report.

J. Summary Request Mode

4.77 Independently of the report mode, the S command listed in the 41-3A Remote Service Analyzer Command Menu (Fig. 38) allows a user to obtain a summary report immediately following a system ready message. Note that this request is different from the S command listed in the report mode menu (Fig. 53).

K. Computer/41-3A Communication Requirements

4.78 The following protocol and data format considerations apply when the Model 41-3A with ERC is operated under control of a host computer (micro, mini, etc.). The following information is intended for use by a programmer or other software personnel.

4.79 Command Entries

4.80 The host computer must send the same mode commands to the Model 41-3A as are entered via a terminal keyboard. After a system reset, for example, the ASCII code SUB (i.e., a keyboard CTRL Z) is required to place the 41-3A in the system ready condition.

> *Note:* All characters sent to the Model 41-3A must be ASCII.

4.81 Mode Messages

4.82 The Model 41-3A transmits the same mode messages to the computer as sent when operated via keyboard control. A line feed (LF) and carriage return (CR) delineate each line of a message. A second CR is attached to the line preceding a prompt (—) character. The two CR's and the prompt are an indication to the computer that the 41-3A is awaiting a command entry. After power-up, for example, the Model 41-3A transmits the following reset message, then awaits ASCII code SUB.

SYSTEM< SP >RESET< LF >< CR>
type< SP >CTRL< SP >Z< SP >for< SP >
SYSTEM< SP >READY.
< LF >< CR >< CR >
>

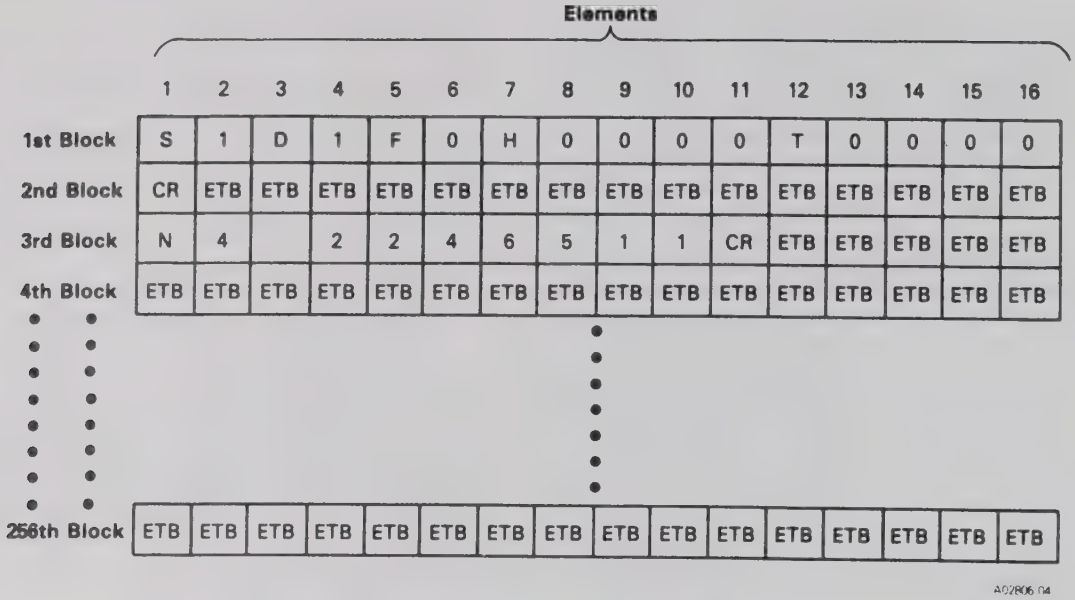

Elements
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1st Block S 1 D 1 F 0 H 0 0 0 0 T 0 0 0 0
2nd Block CR ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB
3rd Block N 4 2 2 4 6 5 1 1 CR ETB ETB ETB ETB ETB
4th Block ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB
256th Block ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB ETB

Fig. 62 — Model 41-3A Program Buffer

Note: The enclosures < > are shown above only to delineate a transmitted SP (space), LF, and CR from other transmitted characters (M, R, e, C, L, Z, etc.). These enclosures (< and >) are **NOT** transmitted; however, the single prompt character (3rd line) **IS** transmitted. The user may eliminate the prompt character after it is received.

4.83 After reception of a system ready notification, the host computer may request the data transfer mode via a D character entry. The Model 41-3A then transmits a mode message and awaits a transfer request from the computer. Assuming the 41-3A contains a call program, the computer may request a dump program or unformatted report data transfer with an appropriate digit entry. The control characters and formats used by the 41-3A to transmit data for use by the host computer are discussed next.

4.84 Dump Program Format

4.85 The Model 41-3A's program buffer is divided into 256 blocks of 16 elements each, where each element is an ASCII character. Program instructions are appended with a CR, and ETB's complete the remaining elements of a block. As an example, the program consisting of instructions S1D1F0H0000T0000 and N44,2246511 is stored as diagrammed in Fig. 62.

4.86 The Model 41-3A dumps its internal call program by first transmitting a Start of Text (STX) indicator. The 41-3A then transmits an image of its program buffer in the form of a continuous string of character records. All 4,096 buffer elements are sent. Normally, the first record contains the first program instruction. Filler codes (ETB's) used to complete an instruction block are sent as part of the next record. An LF is inserted before an instruction's CR code so that these records are appended by segment < LF > < CR >. A string of 40 consecutive ETB's is affixed with a CR. This limits the maximum size of a record sent to the computer. Remaining ETB's (less than 40) are transmitted ahead of a block-check routine, which is sent to facilitate error checking by the host computer. Block-check characters are defined under subject heading Block-Check Generation (paragraph 4.91).

4.87 Table O tabulates the complete format used by the Model 41-3A to dump its call program data. Notice that an acknowledgement from the computer is not required. After its data transmission, the 41-3A sends an exit and system ready message, then awaits a command from the computer. If the computer detects a transmission error, it can request a re-transmission via the data transfer mode.

TABLE O

DUMP PROGRAM FORMAT

CHARACTER/ DATA	DESCRIPTION
STX	Start of text indicator
call program with added control and filler codes	Image of the Model 41-3A's internal call program buffer, consisting of 4,096 ASCII characters. Record blocks are delineated with LF and CR codes. A string of 40 consecutive ETB (filler) codes are marked with a CR. This limits the maximum record size sent to the computer. As an example, the program of Fig. 62 is transmitted as follows. S1D1F0H0000T0000 < LF >< CR > <15 ETB codes>N4,2246511 <LF><CR> <40 ETB codes><CR>\ : | : > (transmitted 101 time) : | <40 ETB codes><CR> / <13 ETB codes>
z BCC1 BCC2 LF, CR	Sequence (z<BCC1><BCC2><LF><CR>) marks the end of data. It is provided to facilitate error checking by the computer. All characters from STX to the final CR must be included in the computer's error detection routine.

Notes:

1. No acknowledgement by the computer is required after the above transmission; the Model 41-3A transmits the following message and awaits a command from the computer.

   EXITING<SP>CURRENT<SP>MODE<LF><CR>
   SYSTEM<SP>READY<LF><CR>
   Type<SP>H<SP>to<SP>display<SP>COMMAND<SP>MENU.<LF><CR><CR>
   >

2. See heading, Block-Check Generation (paragraph 4.91) for block-check character definitions.

3. The computer requests a re-transmission via data transfer mode when a transmission error occurs.

4.88 Report Data Format

4.89 Tables P, Q, and R define the formats used by the Model 41-3A when it dumps unformatted report data (transfer command 6). Table P defines the header block which precedes transmission of the report data. Table Q defines the data format of an individual call report. Table R defines the format of a summary report.

4.90 Several call and summary data blocks may be sent. Complete data blocks are sent by the 41-3A; i.e., no test result categories are truncated regardless of the types of reports requested via the Report Mode (see Part G). The 41-3A awaits a response from the computer after each report. This response can be a reset CTRL Z command (ASCII code SUB) or one of the following:

R (i.e., repeat the last report data)
C (i.e. continue with next report data)
S (i.e., stop data transmission and exit transfer mode).

TABLE P

DUMP REPORT HEADER

CHARACTER/ DATA	DESCRIPTION
SOH	Start of header code
(ID code)	Code assigned via the ID code mode
LF	Segment <LF> <CR> marks the end of this record block
CR	

Notes:

1. Block-check characters are not included with the above transmission.
2. After the above block is sent, unformatted report data is transmitted. (These transmissions may comprise data from several stored call and summary reports.)

TABLE Q

UNFORMATTED CALL REPORT DATA FORMAT

CHARACTER/ DATA	DESCRIPTION
STX	Start of text indicator
E	Indicates the following data is from an individual call report
(dial mode)	ASCII digit 1 – MF, 2 = TT, and 4 = OP
(channel and line)	Indicates the channel and line on which the test call originated. The first byte designates Channel A or B (where 01H = A or 00H = B). The next byte designates the line (where 00H = line 0 and line 7).
(time and date)	Sent as an ASCII 10-digit string which contains the time and date of the report (as determined by the model 41-3A's internal 24-hour clock); for example, the digit string 1138120385 translates to 11:38 AM, December 3, 1985.
(digits dialed)	Sent as an ASCII 32-character string; for example, the string 6032256511EEEEEEEEEEEEEEEEEEEEEE indicates that telephone number 603-225-6511 was dialed. A carriage (CR) ends the 32-character string.
(results flags)	Consists of seventeen 1-byte flags which correspond in order with the following disposition counts. 1. total test (calls) 2. test OK's 3. tests on Channel A 4. tests on Channel B 5. no dial tone (no wink) 6. open C-lead 7. reversal during dialing 8. reorder (no answer) 9. reorder and answer 10. busy and answer 11. busy (no answer) 12. low level 13. no 1-kHz tone 14. high level 15. no answer 16. incoming circuit fault 17. C-message fault Each flag indicates when to increment its disposition category by: 00H = no change 01H = increase count by 1

TABLE Q (Cont'd)

CHARACTER/ DATA	DESCRIPTION
(SIT flags)	This data is valid only if the Model 41-3A is equipped for SIT signal detection. It consists of thirty-two 1-byte flags which are appended to the above result flags in the following order: 18. SIT 00 26. SIT 08 34. SIT 16 42. SIT 24 19. SIT 01 27. SIT 09 35. SIT 17 43. SIT 25 20. SIT 02 28. SIT 10 36. SIT 18 44. SIT 26 21. SIT 03 29. SIT 11 37. SIT 19 45. SIT 27 22. SIT 04 IC 30. SIT 12 38. SIT 20 46. SIT 28 23. SIT 05 31. SIT 13 VC 39. SIT 21 47. SIT 29 24. SIT 06 32. SIT 14 RO 40. SIT 22 RO 48. SIT 30 25. SIT 07 NC 33. SIT 15 41. SIT 23 49. SIT 31 NC Each flag indicates when to increment its disposition category by: 00H = no change 01H = increase count by 1
(1-kHz level)	Sent only if the low or high level test result flag is raised. It consists of three ASCII characters, a positive (+) or minus (−) sign and a 2-digit level value.
(C-message)	Sent only if the low or high level test result flag is raised. It consists of three ASCII characters, a positive (+) or minus (−) sign and a 2-digit level value.
z BCC1 BCC2 LF CR	Sequence (a BCC1 BCC2 LF CR) marks the end of the report. It is provided to facilitate error checking by the computer. All characters from STX to the final CR must be included in the computer's error-detection routine.

Notes:

1. The Model 41-3A awaits and must receive a response from the computer after this report. The response can be an ASCII code SUB (reset), R (repeat), C (continue), or an S (stop).

2. Block-check characters are defined under subject heading Block-Check Generation (paragraph 4.91)

TABLE R

UNFORMATTED SUMMARY REPORT DATA FORMAT

CHARACTER/ DATA	DESCRIPTION
STX	Start of text indicator
S	Indicates a summary-type report
(dial mode)	ASCII digit 1 = MF, 2 = TT, and 4 = DP
(time and date)	Sent as an ASCII 10-digit string which contains the time and date of the report (as determined by the Model 41-3A's internal 24-hour clock); for example, the digit string 1138120385 translates to 11:38 AM, December 3, 1985.
(digits dialed)	Sent as an ASCII 32-character string; for example, the string 6032256511EEEEEEEEEEEEEEEEEEEEEE indicates that telephone number 603-225-6511 was dialed. A carriage (CR) ends the 32-character string.
(result totals)	Data consists of thirty-four 16-bit words. Every two words (4 bytes) contains an ASCII 4-digit total, with the most significant byte sent first. The 4-digit totals correspond in order with the following categories. 1. total test calls 2. test OK 3. tests on Channel A 4. tests on Channel B 5. no dial tone (no wink) 6. open C-lead 7. reversal during dialing 8. reorder (no answer) 9. reorder and answer 10. busy and answer 11. busy (no answer) 12. low level 13. no 1-kHz tone 14. high level 15. no answer 16. incoming circuit fault 17. C-message fault *Note:* As an example, the 4 digit value sent for category 1 might be 0324, indicating that 324 total test calls were dialed to the designated address (digits dialed).

TABLE R (Cont'd)

CHARACTER/ DATA	DESCRIPTION
(SIT totals)	This data is valid only if the Model 41-3A is equipped for SIT signal detection. The data consists of sixty-four 16-bit words. Every two words (4 bytes) contains an ASCII 4-digit total, with the most significant byte sent first. These totals are appended to the above totals in the following order. 18. SIT 00 26. SIT 08 34. SIT 16 42. SIT 24 19. SIT 01 27. SIT 09 35. SIT 17 43. SIT 25 20. SIT 02 28. SIT 10 36. SIT 18 44. SIT 26 21. SIT 03 29. SIT 11 37. SIT 19 45. SIT 27 22. SIT 04 IC 30. SIT 12 38. SIT 20 46. SIT 28 23. SIT 05 31. SIT 13 VC 39. SIT 21 47. SIT 29 24. SIT 06 32. SIT 14 RO 40. SIT 22 RO 48. SIT 30 25. SIT 07 NC 33. SIT 15 41. SIT 23 49. SIT 31 NC *Note:* As an example, the 4-digit value sent for category 1 might be 0003, indicating that three test calls resulted in the detection of a SIT 00 signal.
z BCC1 BCC2 LF CR	Sequence (a <BCC1> <BCC2> <LF> <CR>) marks the end of the report. It is provided to facilitate error checking by the computer. All characters from STX to the final CR must be included in the computer's error-detection routine.

Notes:

1. The Model 41-3A awaits and must receive a response from the computer after this report. The response can be an ASCII code SUB (reset), R (repeat), C (continue), or an S (stop).

2. Block-check characters are defined under subject heading Block-Check Generation (paragraph 4.91)

4.91 Block-Check Generation

4.92 The Model 41-3A provides a longitudinal parity check for error detection. Two block-check characters (designated BCC1 and BCC2) are calculated so that the exclusive OR of all characters in a transmitted block produces a result of 00H.

- BCC1 is defined by the expression **BCC1 =[Accum +} plus 70H * 40H +70H,** where [Accum +] is the accumulated exclusive-OR of all transmitted characters except BCC1 and BCC2. Character BCC1 can only be an ASCII 0 (zero) or lowercase letter p.
- **BCC2 = [Accum +] + BCC1.** It can be any character from zero (0) to the lowercase letter o.

Note: The Model 41-3A sets all ASCII parity bits (bit 8) to zero when transmitting, and ignores this parity bit when receiving.

4.93 The following procedure details the calculations used by the Model 41-3A to generate block-check characters. The host computer must provide block-check characters in the same manner when it loads the 41-3A with a call program.

(1) An exclusive-OR'ed result is determined for all characters to be transmitted, except BCC1 and BCC2 which will be calculated later. The program of Fig. 62 is used below to demonstrate Step 1. Block elements are listed in two columns for ease of presentation. Also, repeated codes are indicated at the right of the binary code. The final result is 6EH.

COLUMN A				COLUMN B			
ASCII CODE	HEX CODE	BINARY CODE	(REPEATS)	ASCII CODE	HEX CODE	BINARY CODE	(REPEATS)
STX	02	0000 0010		4	34	0011 0100	
S	53	0101 0011		,	2C	0010 1100	
1	31	0011 0001		2	32	0011 0010	(2)
D	44	0100 0100		4	34	0011 0100	
1	31	0011 0001		6	36	0011 0110	
F	46	0100 0110		5	35	0011 0101	
0	30	0011 0000		1	31	0011 0001	(2)
H	48	0100 1000		LF	0A	0000 1010	
0	30	0011 0000	(4)	CR	0D	0000 1101	
T	54	0101 0100		ETB	17	0001 0111	(40)
0	30	0011 0000	(4)	CR	0D	0000 1101	(1) (101)
LF	0A	0000 1010		ETB	17	0001 0111	(13)
CR	0D	0000 1101		z	7A	0111 1010	
ETB	17	0001 0111	(15)	LF	0A	0000 1010	
N	4E	0100 1110		CR	0D	0000 1101	
					6E	0110 1110	(Step 1 result)

(2) Add 70H to the result of Step 1.

```
0110  1110  (Step 1 result)
0111  0000  (70H)
---------
1101  1110  (Step 2 result)
```

(3) AND the result of Step 2 with hexadecimal 40.

```
1101  1110  (Step 2 result)
0100  0000  (40H)
---------
0100  0000  (Step 3 result).
```

(4) Exclusive–OR the result of Step 3 with hexadecimal 70.

```
0100  0000  (Step 3 result)
0111  0000  (70H)
---------
0011  0000  (Step 4 result)
```

(5) Set BCC1 equal to the result of Step 4 (i.e., BCC1 = 0011 0000). BCC1, for this example, is ASCII number zero (0).

(6) Exclusive–OR the result of Step 1 with BCC1.

```
0110  1110  (Step 1 result)
0011  0000  (BCC1)
---------
0101  1110  (Step 6 result).
```

(7) Set BCC2 equal to the result of Step 6 (i.e., BCC2 = 0101 1110). BCC2, for this example, is ASCII code (SHIFT N).

(8) Both BCC1 and BCC2 are now defined. These characters are preceded by the lowercase letter z and followed by an LF and CR code. The Model 41-3A dumps the example program of Step 1 as shown below. Continue to Step 9.

```
STX  S1D1F0H0000T0000  LF   CR
15 ETB codes  N44,2246511  LF   CR
40 ETB codes  CR
      :
      :                    (101 times)
      :
40 ETB codes  CR
13 ETB codes  z0   LF   CR
```

(9) This is the end of the above step-by-step procedure for generating block-check characters. The computer must include all received characters from STX to the final CR in its longitudinal parity check. The exclusive–OR of these characters must produce a result of 00H. This result is demonstrated below for the example transmission of Step 8 by calculating the exclusive–OR of codes BCC1 and BCC2 with the result of Step 1.

```
0110  1110  (result from Step 1)
0011  0000  (BCC1 from Step 5)
0101  1110  (BCC2 from Step 7)
---------
0000  0000  (NUL result 00H)
```

4.94 Load Program Format

4.95 When a call program is loaded into the Model 41-3A, the program source may be a computer or tape drive.

4.96 Table S defines the format required when a call program is loaded into the Model 41-3A via command 8 of the data transfer mode (i.e., load program from host device into 41-3A.). In order to meet internal timing requirements of the 41-3A, the host device must send the program format of Table S immediately after initiating command 8. As shown in Table S, a Start of Text (STX) indicator must precede the call program data, and a computer generated block-check segment must follow. The call program format is similar to the format of Table P, except that LF's are not required, and consecutive ETB's are not affixed with a CR.

> *Note:* Although the Model 41-3A transmits data over the full range of baud rates given in Fig. 2, the 41-3A is restricted to a maximum of 100 characters per second (i.e., a baud rate of 1200) when receiving continuous data.

TABLE S

LOAD PROGRAM FORMAT

CHARACTER/ DATA	DESCRIPTION
STX	Start of Text indicator
program data	This is the program stored in the host computer. It must consist of 4,096 call program characters (this includes CR delineators and ETB fillers). As an example, a program could consist of the following characters. S1D1F0H0000T0000<CR> <15 ETB codes>N44,2246511<CR> <4053 ETB codes>
z BCC1 BCC2 LF CR	This segment marks the end of the transmitted data block. Characters BCC1 and BCC2 must be calculated as defined under subject heading Block-Check Generation (paragraph 4.91). For the above example program BCC1 = 0 (zero) and BCC2 = S.

Notes:

1. All received characters from STX to the final CR are included in the Model 41-3A's block-check routine. If the 41-3A block-check fails, it transmits the message **ERROR MODE CONDITION.**
2. When loaded, the example call program used above is stored in the 41-3A as shown in Fig. 62.
3. After execution of a load program command, the 41-3A transmits an exit and system ready message, then awaits a command from the computer.

TABLE T

RECORD FORMAT

TAPE DRIVE COMMAND CODE	TAPE DATA CODES	DATA CODE FUNCTION
DC2		
	SI	SI is a keyboard CTRL O command; i.e., it sets the Model 41-3A in its operate mode.
	ETB (60)	These are (CTRL W) filler characters which allow time for the 41-3A to perform certain operate mode software routines.
DC4		
DC2		
	ETB (60)	Same function as above.
DC4		
DC2		
	ETB (30)	Same function as above.
	2 (11)	Causes Model 41-3A to execute command 2 of its operate mode (i.e., Run program from tape). Eleven digits are used to ensure the reception of a digit 2 by the 41-3A.
	LF	
	CR	
DC4		
DC2		
	(ID code)	This ID data is the tape's program name (up to 32 characters).
	LF	
	CR	
	DC3	This is an M2500 stop send command used by the 41-3A load routine.
DC4		

TABLE T (Cont'd)

TAPE DRIVE COMMAND CODE	TAPE DATA CODES	DATA CODE FUNCTION
DC2		
	STX	Start of Text indicator for program data.
	(program)	This is the call program which the 41-3A retrieves from tape when it executes command 2 of its operate mode. This program data consists of 4,096 characters. As an example, the data might consist of the following record strings. (Notice that this program data is formatted in the same manner as is shown in Table S.) S1D1F0H0000T0000 <CR> < 15 ETB codes > N44,2246511 <CR> < 4053 ETB codes >
	z BCC1 BCC2 LF CR	This segment must append the program data. Characters BCC1 and BCC2 must be calculated as defined in paragraph 4.91, under subject heading Block-Check Generation. For the above example program, BCC1 = 0 (zero) and BCC2 = S.
DC4		
DC2		
	ETB (30)	This record sequence must be repeated 12 times (i.e., a total of 360 ETB codes must be stored on tape).
DC4		
ESC SYN		

Note: If the above taped program is loaded into the Model 41-3A, only the data codes beginning with STX and ending with the final CR are included in the Model 41-3A's error check.

TABLE U

25 PAIR CONNECTOR

APM CONN. NO.	CONNECTING CABLE			CLIP TERM.	BLOCK NO.
	PAIR		COLOR		
26	T	1	W-BL	1	1
1	R		BL-W	2	
27	S	2	W-O	3	
2	T		O-W	4	
28	R	3	W-G	5	
3	S		G-W	6	
29	T	4	W-BR	7	
4	R		BR-W	8	
30	S	5	W-SL	9	
5	T		SL-W	10	
31	S	6	R-BL	11	2
6	R		BL-R	12	
32	T	7	R-O	13	
7	R		O-R	14	
33	S	8	R-G	15	
8	T		G-R	16	
34	R	9	R-BR	17	
9	S		BR-R	18	
35	T	10	R-SL	19	
10	R		SL-R	20	
36	S	11	BK-BL	21	3
11	T		BL-BK	22	
37	R	12	BK-O	23	
12	S		O-BK	24	
38	T	13	BK-G	25	
13	R		G-BK	26	
39	S	14	BK-BR	27	
14	T		BR-BK	28	
40	R	15	BK-SL	29	
15	S		SL-BK	30	
41	T	16	Y-BL	31	4
16	R		BL-Y	32	
42	S	17	Y-O	33	
17	T		O-Y	34	
43	R	18	Y-G	35	
18	S		G-Y	36	
44	T	19	Y-BR	37	
19	R		BR-Y	38	
45	S	20	Y-SL	39	
20	T		SL-Y	40	
46	R	21	V-BL	41	5
21	S		BL-V	42	
47	T	22	V-O	43	
22	R		O-V	44	
48	S	23	V-G	45	
23	T		G-V	46	
49	R	24	V-BR	47	
24	S		BR-V	48	
50		25	V-SL	49	
25			SL-V	50	

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